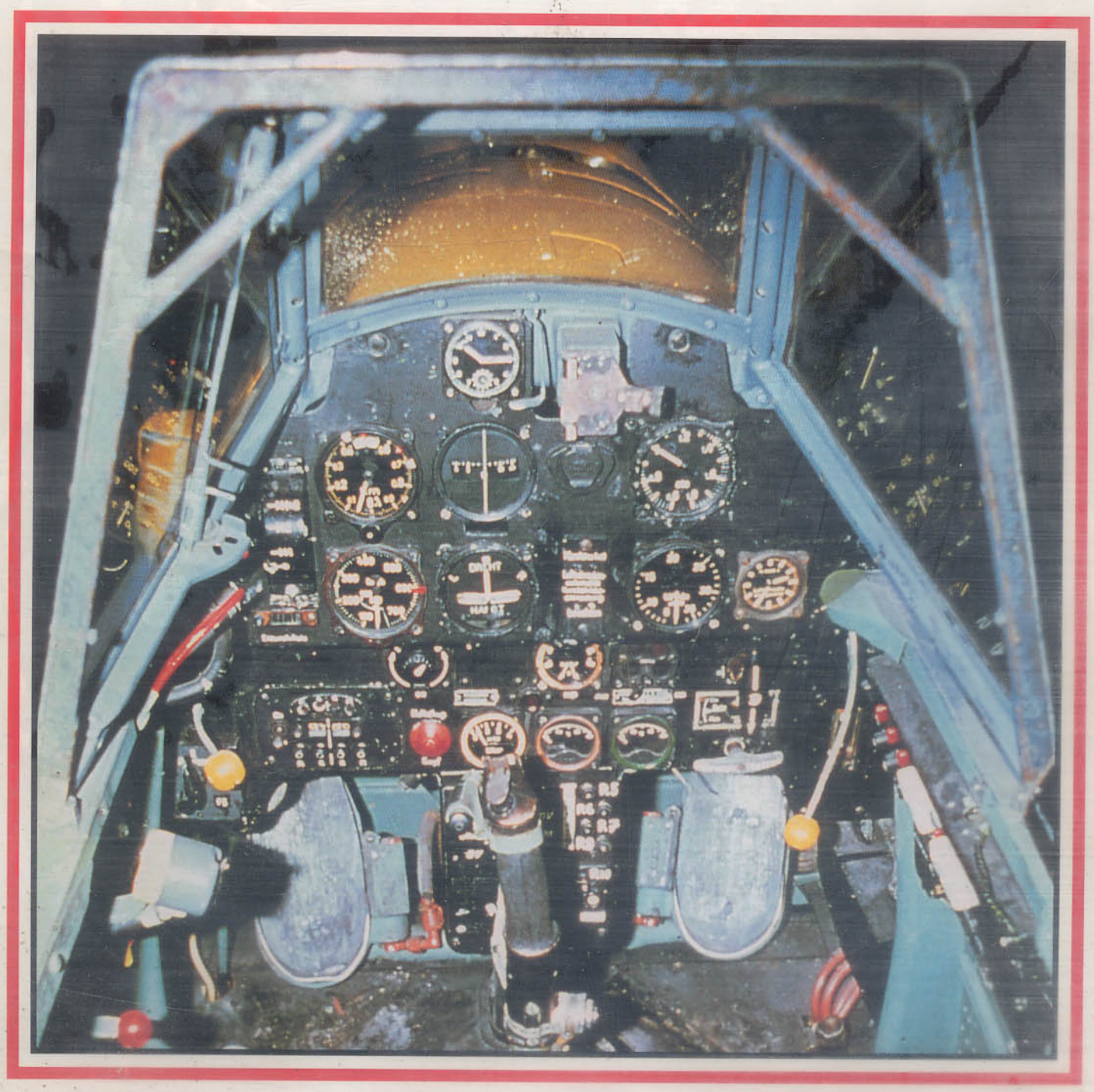
GERMAN AIRCRAFT INTERIORS 1935-1945

VOL 1



KENNETH A. MERRICK

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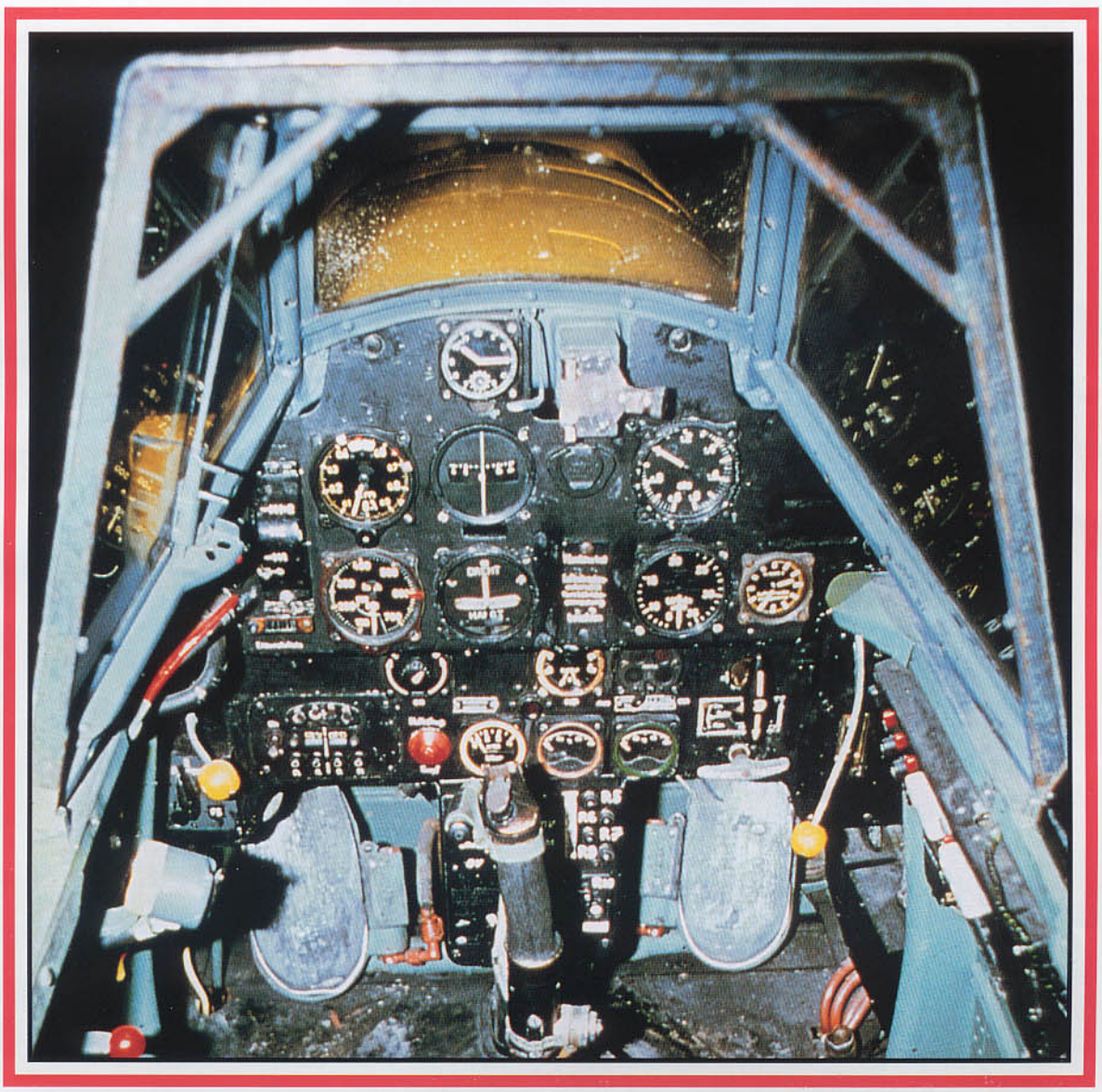

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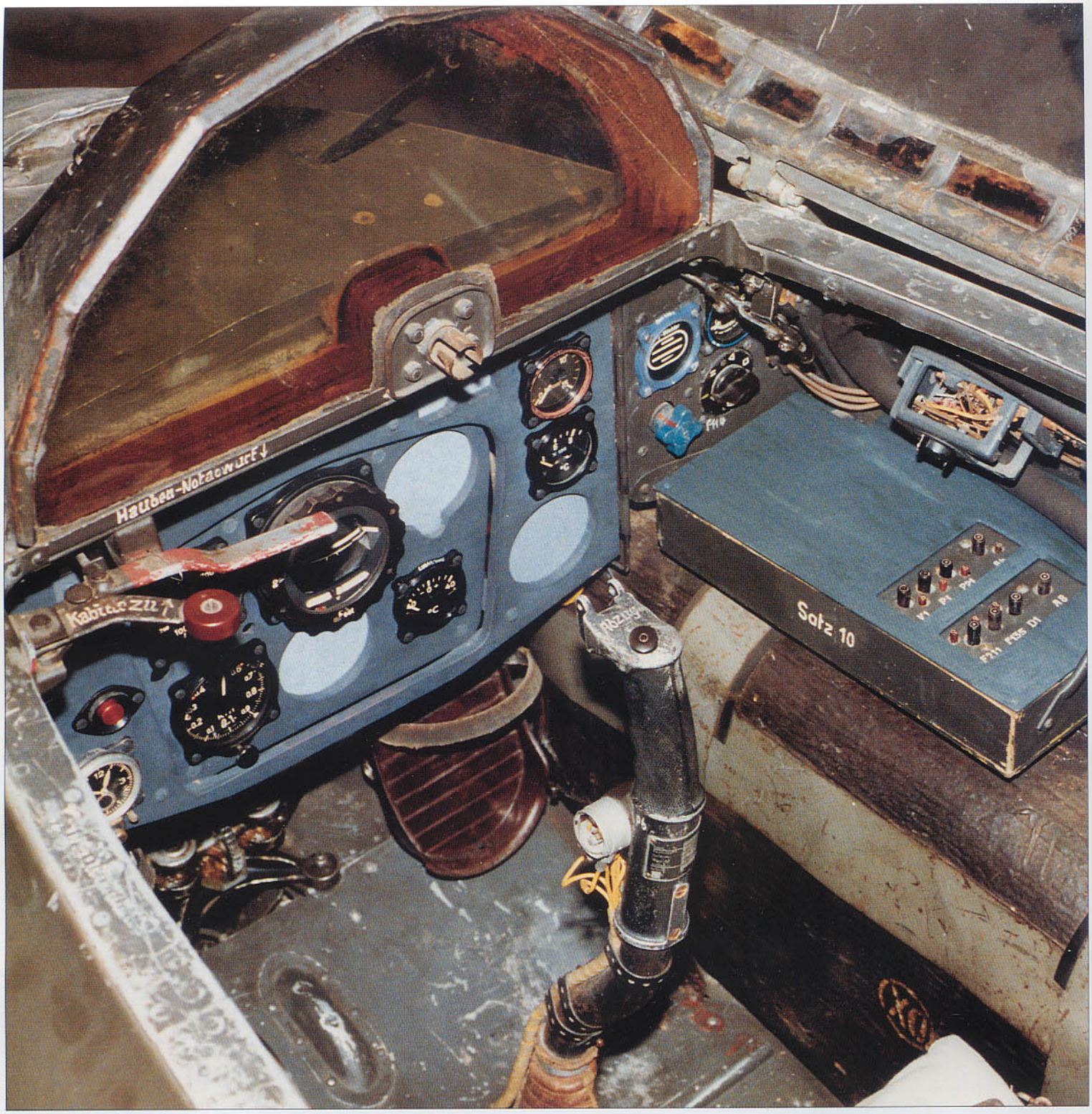


INTRODUCTION

Restrictions placed on the production of armaments following the Great War by the Treaty of Versailles witnessed the immediate demise of numerous well-established German aircraft firms. By a series of ploys, however, a few were able to survive into the 1930s, albeit under new guises. More fortunate for the aircraft industry was the pool of professional talent which remained intact concurrently with the rise to power of the National Socialist German Workers Party. Their collective skills were resurrected under a vigorous government rearmament policy.

German military aircraft construction techniques had reached a high standard prior to the outbreak of war in Europe in 1939. However, aircraft design was strongly influenced by Germany's vaunted military tacticians who embraced the much-publicized *Blitzkrieg* (Lighting war) technique. Those perceptions were ultimately to rob the designers of much of their latent talents. In spite of this shortcoming, those products that flowed from the production lines ushered in an impressive series of aeronautical advances which were, at times, breathtaking in their concept and application.

The tactical dictums imposed upon the designers placed heavy emphasis upon hand-held defensive armament, and the Rheinmetall-Borsig T6-220 7.9 mm (MG 15) machine gun became the standard for much of the war period. Mounting of this weapon varied from the scarfe-ring mounted open installation to more sophisticated streamlined and enclosed designs. In the former case, the *Mechanische Werkstätten Neubrandenburg* company was the chief supplier at the outbreak of war. Aerodynamic screening for these drag-inducing installations was restricted to the provision of small windscreens or fully retractable cupolas.

Two other types of hand-operated mountings were produced by the Arado company and Dola. The first utilized a pivot arm fitted parallel to the longitudinal axis of the aircraft to provide lateral movement. The Dola mounting consisted of a moveable stirrup attached to brackets which were anchored to the fuselage.

Enclosed gun mountings, within cupolas, offered distinct advantages over the types mentioned above. Light, of small diameter, they created little drag, offered a reasonable field of fire and were easy to operate. Two types were developed, one hand-operated, the other electrically powered. The Ikaria 710 was commonly used as the nose mounting in such types at the Junkers Ju 86 and Heinkel He 111. Built up on a light metal frame and covered with Plexiglas, the offset center housed a ball mounting for the machine gun. A counter-balance weight relieved the gunner of most of the physical strain of rotating the entire cupola. Mounting was not restricted to the nose position; the cupola could also be installed parallel to the longitudinal axis of the aircraft, or at an angle. The Z10d-type mounting was of slightly heavier construction, but had the advantage of a much shallower profile; and like the Ikaria 710, it could be installed in a variety of ways, being used principally in the rear defensive positions on the He 111 and Dornier Do 215 aircraft.

The Z10d was a modified, unpowered version of the Siemens SAM electrically operated turret, which had a 180° traverse in all planes. Two motors supplied movement in the horizontal and vertical planes, respectively, control being by means of a pistol trigger switch. The gun was mounted on moveable metal stirrup. At 30 kg (66 lb), it was the heaviest of the turrets described above. Improved versions of electrically operated turrets began to appear early in the war, and these were fitted to the later generation of bombers, such as the Do 217 and He 177.

Armament positions were identified by the terminology of A-Stand for the nose position, B-Stand for the dorsal position, C-Stand for the ventral position and D-Stand for the aft-facing position. For the introduction of multiple defensive positions (e.g. He 177), this system was modified by the addition of -1, -2, etc. after the principle identification.

The *Luftwaffe* , while adhering to hand-held and operated guns, was quick to realize that fixed-sighting devices, such as the standard Type 65 ring and bead, were totally inadequate in the face of modern high-speed aircraft. Reflex optical gun sights (Reflex Visier, abbreviated to Revi) were thus introduced for a wide range of armament. The Revi 3a was the principle sight used for fixed guns when war broke out, but improved, models were introduced as aircraft speeds began to dramatically increase. The Revi 3a was the beginning of a long line of such sights, which would include the Revi 3b, 3d, C/12C, C/12D, 16A, 16B, 16D and 16G. A reflex sight for moveable guns, the EZ-6A, was also in use by 1940. With the introduction of electrically operated turrets, the small THm/44Kk turret sight was added to the list, but many of those turrets utilized the Revi 16A and 16B models.

Fixed guns, such as the Rheinmetall-Borsig T6-200 7.9 mm machine gun or 20 mm cannon, operated by the pilot, were fired by means of a trigger device fitted to the control column pistol grip in fighter aircraft. In addition to this trigger, a gun charging button (compressed air was used for cocking and firing) and a microphone switch were built-in around the top of the grip. A similar arrangement for firing was fitted to the single 20 mm cannon-armed turrets of the late-war bombers.

Opposite: Cockpit of the Australian Me 163 B-2 (See page 242).

Bomb racks were either of the horizontal or vertical stowage type, the latter being found in such aircraft as the Ju 86 and He 111, while the former was favored by the Do 17 and its successors, the Ju 88 and Ju 188 series, etc.. There were advantages and disadvantages with both types of installations. Vertical bomb stowage allowed a range of varying sizes and weights to be carried and dropped without regard to specific sequencing. By contrast, horizontal stowage required the lowest bomb in the rack to be dropped first, with subsequent limitation on selectivity. However, horizontally launched bombs were already the best aerodynamic attitude and produced more reliable aiming results. The Reikow A16 was one of several devices used for sequenced release of bombs, the 16-suffix indicating it controlled a maximum of 16 bombs. It was very flexible, allowing bomb sequence changes almost up to the point of release; both groups or single bombs, virtually in any combination, could be used.

Several types of bomb sights were in use at the outbreak of

hostilities. The simplest was the Kuvi 2 course sight, which could also be used by the pilot when making either dive-bombing, or shallow-angle attacks. Angle lines painted on the side window, set at various degrees to the horizontal, could be used in conjunction with Kuvi 2 or its successors for such attacks. Alignment of the chosen angle line with the general horizon gave the pilot an indication of his diving angle and the wires of the Kuvi 2 provided the drift indication. For level bombing the standard GV219d mechanical bomb sight had been virtually superseded by 1940 (but continued in limited use, e.g. Fw 189), the Lotfe c7/A prismatic sight replacing it. This in turn was replaced by the improved Lotfe 7B sight which incorporated the BZG2 telescopic devices. For dive-bombing, the Stuvi 5B periscopic sight was fitted to a wide range of aircraft, such as the Do 17, Do 215, Do 217, He 177, Ju 88 and Me 410. In some instances, where forward- firing guns were operated by the pilot, such as on the Do 217E, a Revi gunsight was also fitted. Stuvi sight was fixed to the upper canopy framework so that the pilot could look slightly upwards into the bottom mirror of the sight. On earlier types, such as the Do 17, it was fixed; but on other types, provision was made to swing the sight sideways for stowage when not required.

Despite such sophisticated equipment, German bombers and fighters were both usually seen to have one or more standard diving angle lines marked on the pilot's section of the cockpit Plexiglas canopy. On bomber aircraft, this usually took the form of four short intersecting lines on the side canopy next to the pilot's head. Each angle was identified by color: 40° in red, 50° in black, 60° in white, 70° in brown. In some instances, the actual dive-angle degree-marking was added. The pilot put the aircraft into a dive and then aligned the selected angle-marking with the general horizon. In other instances, a primary dive-line was painted completely around the canopy from port to starboard (e.g. Ju 88 A-4). Fighter aircraft usually had a single dive-angle marked around the entire canopy, primarily the 40° red line (e.g. Bf 109 F-4), but some others had the 60° white line added (e.g. Bf 109 G-6).

Radio equipment shows little change following the introduction of FuG 10P equipment in the late 1930s. Fitted into easily detachable modules for servicing, it was sturdy, reliable and relatively easy to operate.

Navigation equipment, both for pilot and observer, centered around the Patin-manufactured repeater compass. This appeared in two basic forms. The first was a standard repeater dial fed from the master compass and located in the rear of most aircraft to avoid electrical interference. The second form had a superimposed back bearing dial fed from the direction-finding loop. Most aircraft also carried an oil-filled magnetic compass as a back-up for emergency use. The advent of more sophisticated radio homing devices, such as AFN-1 and AFN-2, added extra aids in the cockpit. However, much of the navigation remained reliant upon the basic, but very reliable, equipment with which the *Luftwaffe* had gone to war in 1939.

Ancillary equipment exhibited perhaps the least change during the war. The oxygen economizer bottle, in its distinctive perforated cover, was a common sight from the mid-1930s, but, by 1942, a smaller light-weight version was introduced, still protected by the distinctive perforated cover. The oxygen regulator, with its equally distinctive saucepan shape, was still in use in 1945. Interestingly, postwar Soviet fighter aircraft continued to use the design up to at least the MiG-17.

Instrument panels varied in construction, with both aluminum and wood being used. Wooden types employed a composite ply structure, and more use was made of this material as the war progressed and the need to conserve strategic materials grew. Auxiliary panels became more and more complex as aircraft engineering grew more sophisticated. However, in spite of their complexity, the basic layout involving engine and flight instruments changed very little up to the end of the war in 1945. The German aviation industry had a strong core of respected instrument manufacturers using mostly indigenous designs, which were also successfully marketed overseas prior to 1939. However, some license-manufactured copies of American instruments were also built in Germany. Sperry of New York was one such firm involved in the controversial agreements during the late 1930s. During the 20s and early 30s, there had been an international market in aircraft instruments, but with the worsening political climate in Europe, potential resources quickly evaporated once hostilities erupted in September, 1939.

The instruments themselves remained little altered despite the advances, the only real variations being the introduction of some specialist instruments such as appeared with the introduction of jet and rocket engines for aircraft. Some refinements to the calibration ranges were introduced, but for piston-engined aircraft, the range showed little change between 1939 and 1945. Some minor variation could be detected between products of manufacturers of the same instrument, but in general such changes were cosmetic. Perhaps the only significant change to instrument layout occurred with the improvements in cockpit design for the Do 17 and He 111.

Crew seating also remained virtually unaltered, either in the design of the seat or the materials used. Some manufacturers utilized the same seats for different aircraft models, such as the He 111 and He 115. Some quite specialized designs appeared, and in some cases disappeared, such as the gunner's seat in the early models of the Bf 110. This elaborately designed extrusion had begun to disappear by 1940, in favor

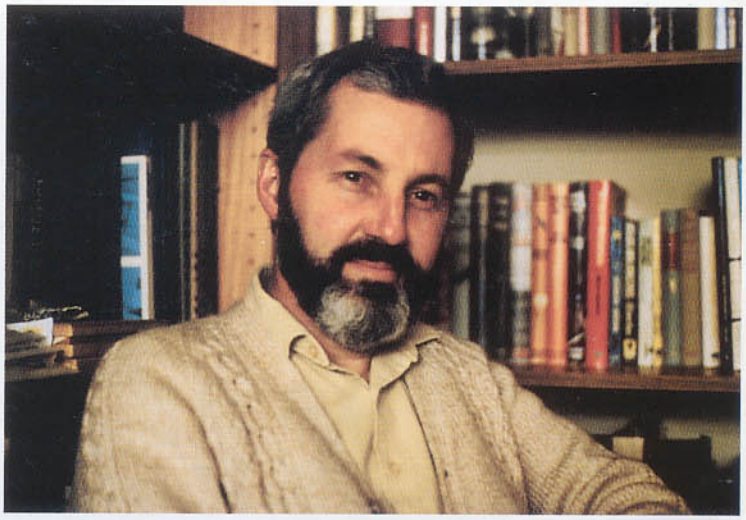
of the simple frame-and-webbing variety. It is only when one examines the heavy transport or flying boat does one see any degree of real sophistication. The advent of the ejector seat for types such as the He 219 and Do 335 saw no such luxury of design, the seats being kept to a very basic configuration, for obvious reasons.

The policy of seating crew members shoulder-to-shoulder or back-to-back produced relatively compact cockpits in some aircraft such as the Do 17 and Ju 88. Wartime test reports published by the Allies on captured enemy aircraft brought some critical comment on this aspect of their design. Late-war bombers, such as the He 177, were of more generous proportions for all crew positions. The pilot's view from most German bomber types was excellent when compared to many Allied aircraft of similar class. However, German fighter aircraft were not exempted from similar critical remarks in the wartime Allied press. American test pilots frequently commented on the narrowness and restricted head-height of standard German fighters, such as the Bf 109.

The official color standard for cockpit interiors for all aircraft types was set as RLM color 66 Black-Gray. The official order prescribing that all areas of the interior that could be viewed by the pilot, from any angle, through the glazing, were to be in this flat-finish color. Those prewar aircraft in service use tended to carry a few variations to this standard. RLM color 02 Gray (a gray-green color) was found on the cockpit walls and cabin framing of some aircraft. Similarly, the instrument panels of some prewar aircraft were painted in RLM color 02 or color 41 Gray. Those interior areas of the aircraft not normally viewed from the cockpit were not usually painted, or if they were, they received a clear coat of RLM color 00 Water Bright, which served as an anti-oxidant. Instrument cases were primarily finished in RLM color 22 Black or RLM color 02; however, the front face surround was always painted in RLM color 22 Black. Instruments which indicated specific engine services and functions were usually color-coded around all or part of their rims. Examples include fuel in RLM color 04 Yellow, oil in RLM color 26 Brown, coolant in RLM color 25 Bright Green and oxygen in RLM color 24 Dark Blue. Battery boxes were almost always painted RLM color 42 Gray (a more pure gray than 02). Markings for electrical equipment usually carried a stylized lightning-bolt emblem in RLM color 23 Red. On some instruments, only a portion of their rim would be marked in the indicative color; the remainder would be painted in sections denoting maximum limits. Wiring looms were color-code matched to the instruments they served. In addition, a small white alpha-numeric marking was applied by the use of decals, or hand painted, along side each instrument to denote its electrical circuit. This logical system appears to have been introduced sometime in 1938. Instructional notices in and around the interior of the cockpit were applied in a variety of ways: decals, painted or etched aluminum plates, templates or simply hand painted. Aircraft identification plates, or tags, denoting the aircraft type, its serial number and possibly its manufacturer, were occasionally fastened to the airframe's interior. This was especially true for small plates attached to many parts found on all aircraft, such as ailerons, main spars, landing gear, control columns and rudders.

ACKNOWLEDGMENTS

A work of this scope was only possible through the unselfish efforts of many people. However, it must be emphasized that even with such wide and generous resources it is virtually impossible to cover every variation which turned up in the cockpits of aircraft produced by the German aviation industry between 1935 and 1945. With this limitation in mind, the reader will still find a wealth of material to satisfy the most demanding interest. Every effort has been made to provide



as wide and as representative a selection as is practical in two volumes. Virtually all the contents of this work have been drawn from official manuals and catalogs of the period. Originals were used where possible, but many were in such poor condition that, by necessity, they had to be professionally redrawn.

I wish to express my sincere gratitude for the generosity and patience of a number of people and institutions who have assisted me over the past decade. In Germany, Dr. Heinz Mankau, Dr. Karl Kössler, Rick Chapman and the staff of the Deutsches Museum were extraordinarily resourceful in supplying a great deal of original material. From Scandinavia, Dr. William Berge of Norway and Doug Carrick of Sweden provided much valuable material from their sizable collections. In the United Kingdom, John Vasco provided a link with German veterans while Steve Coates, J. Richard Smith and Eddie Creek were equally generous. Philip Reed and his staff at the Imperial War Museum provided essential material. In the United States, I extend a special thanks to Richard P. Lutz, Jr. and Dr. Charles Metz,who provided insight and help with photographic requirements. To my publisher, Tom Hitchcock, a special word of thanks for being the easiest publisher I have had the pleasure to work with. I thank him most sincerely for his allowing me such freedom with the work and for his friendship throughout the long publication process. Here in Australia, David Vincent proved his usual resourceful self, while Eric Sommer and Wing Commander Dave Richardson added their own special contributions. Martin Mednis generously allowed access to his splendid private collection of instruments while Peter Sledge translated them into well posed color photographs. Kevin Ginnane's, skill as a professional photographer was deeply appreciated for the many splendid black and white shots found in this work. To my wife Rae, there are insufficient words to adequately record my thanks for her unstinting support throughout the years spent on this project. The wives of aviation authors are truly extraordinary people. Rae personifies the ideal, and I am eternally grateful to her for all she has done for me and this work. The wives of authors are truly very special people. To all, my most sincere thanks.

Kenneth A. Merrick

Greenwith, South Australia

Hersteller	Askania-Werke A.C.
Baumuster	Lg 14.H
Unterdruck mm WS:	400-600
Werknummer.	293766
Gewicht Kg:	0.70
Fertiggestellt am:	1. 6. 35.
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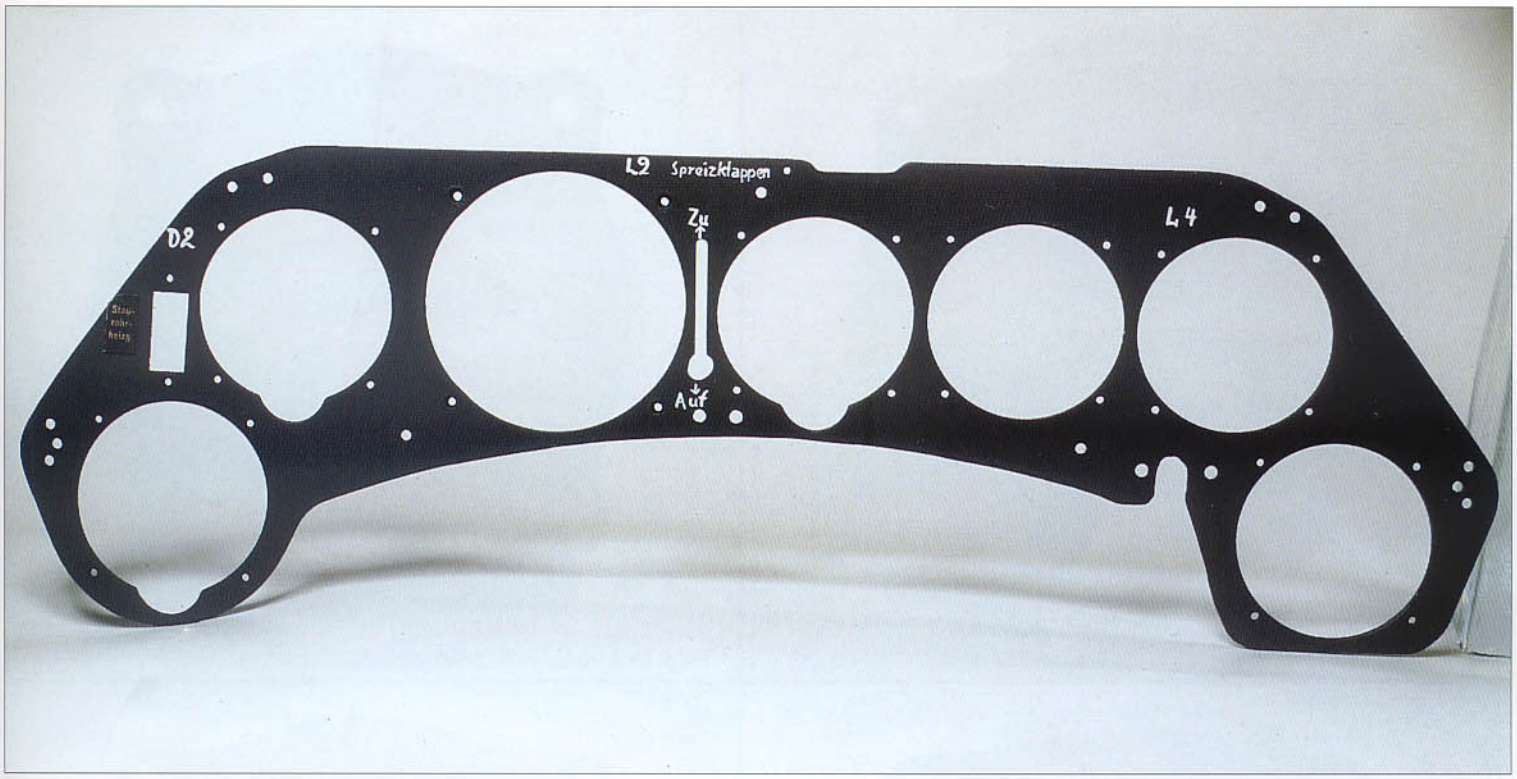
CHAPTER 1
INSTRUMENTATION, CONTROLS AND SYSTEMS



FLIGHT INSTRUMENTATION

German manufacture of aircraft instruments was prolific, in keeping with the constant demands imposed by a massive aircraft industry and the general attrition of wartime usage. Some idea of the scale of production is reflected in the number of such items captured in 1945 *solely* in the British Zone of Occupation - 145,807. During the early part of the war some items had been license built American Sperry (flight and navigation instruments) or Kollsman (flight and engine instruments) but these were only a fraction of the overall production.

Each instrument was marked with details of its manufacture, usually in the form of a thin aluminum plate attached to the body of the instrument in a location that could only be read when the instrument was removed. Details were reasonably uniform though some variation to the information and its order of presentation did appear on occasion. The general format is shown in the accompanying photographs of a turn and bank indicator designed and built by the Askania-Werke AG :

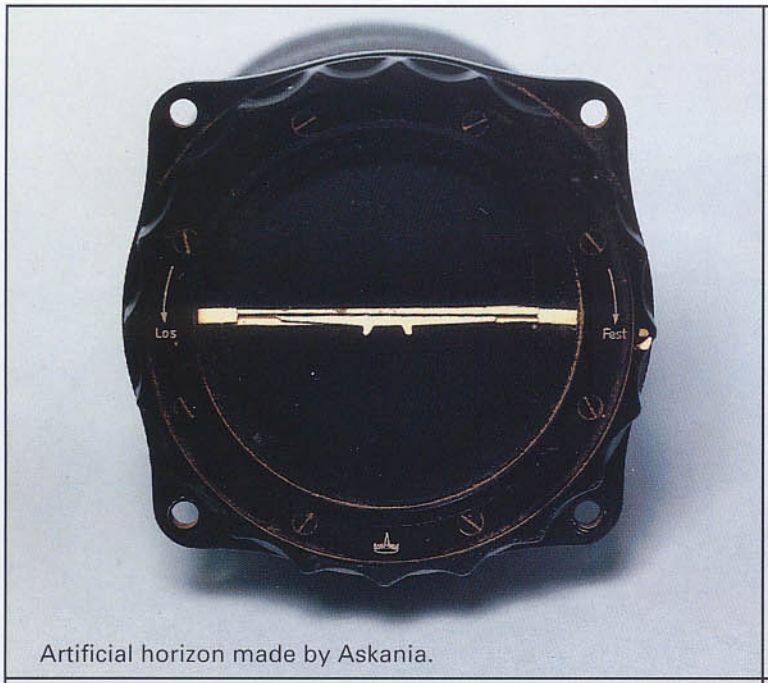
Gerät - Instrument description
Hersteller - Manufacturer
Baumuster - Type/model
Unterdruck mm WS - Low pressure limits
Werk nummer - Serial number
Gewicht kg - Weight in kilograms
Fertiggestelt am - Year of manufacture
Mustergepruft - Model approval date
Anforderungszeichen - Stores reference mark

The *Werk nummer* also appeared pressed into the metal face of the instrument and prefixed with the letter "W."Instrument type designation also appeared on the face of instruments manufactured in the mid-to late 1930s, but this was eventually replaced by the *Anforderungszeichen*, either on the face beneath the glass, or as a base relief marking around the edge of the frame.

Instrumentation was divided into four main groups: engine (temperature, pressure, fuel contents, etc.), flight (blind flying instruments), navigation (compass, homing systems) and specialized items such as armament. Manufacturers included Askania, Brun, Plath, Ludolph, Hartmann *und* Braun and Siemens. While most manufacturers tended to specialize, e.g. Plath and Ludolph were both compass makers, Askania was preeminent in its diversity.

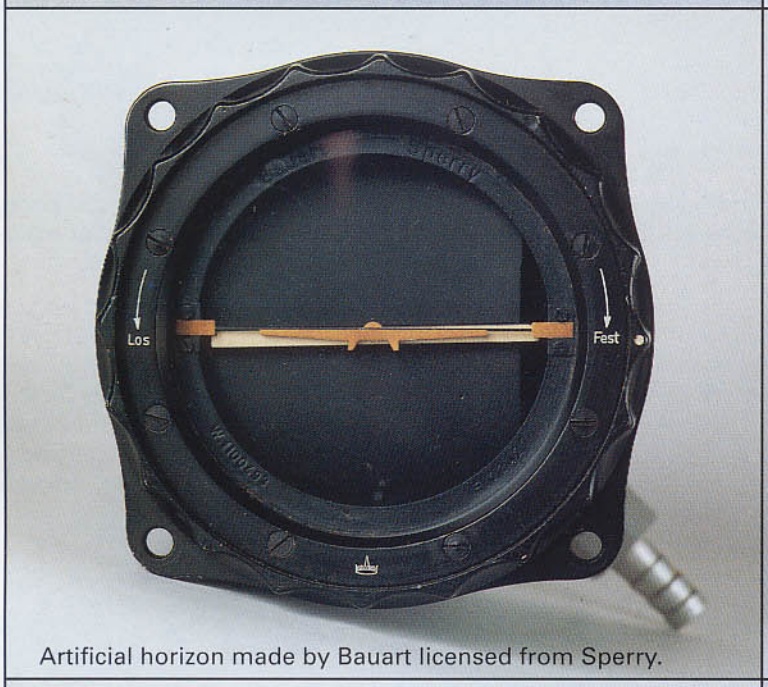
Opposite: Standard German gunsight for fighters of the mid 1940s was the Revi C/12D.

Above: Main instrument panel for the Focke-Wulf Fw 190 A-8. Metal was still the preferred material during the first half of 1944.

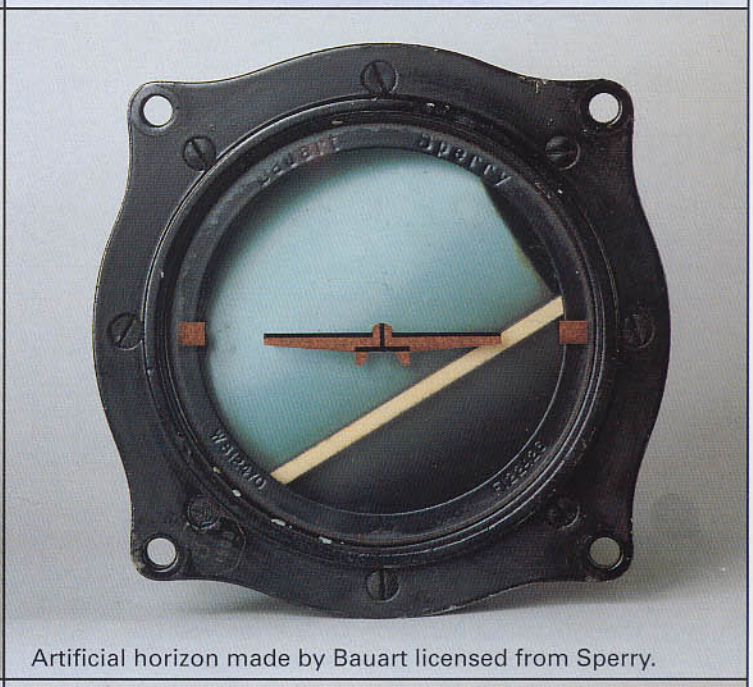


Artificial horizon made by Askania.

Turn and bank indicator.

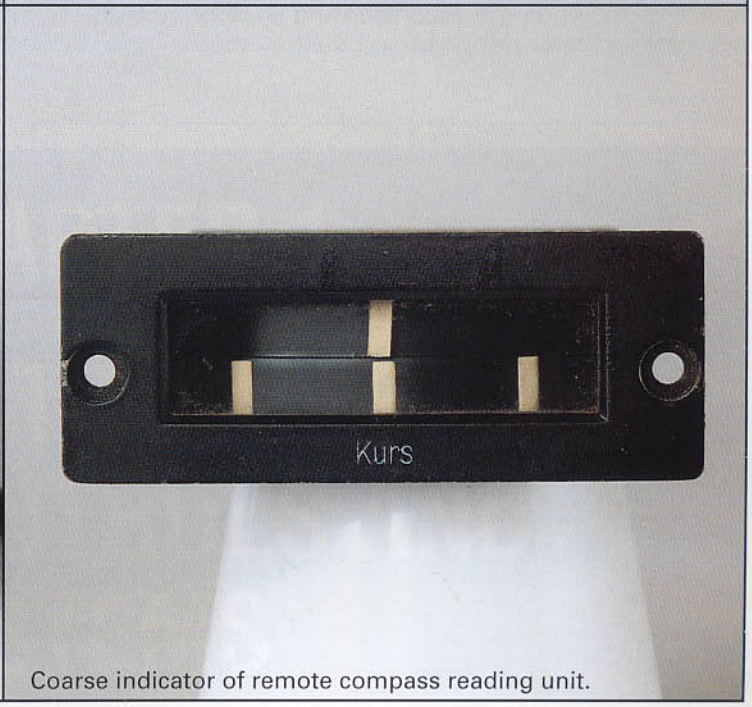


Artificial horizon made by Bauart licensed from Sperry.

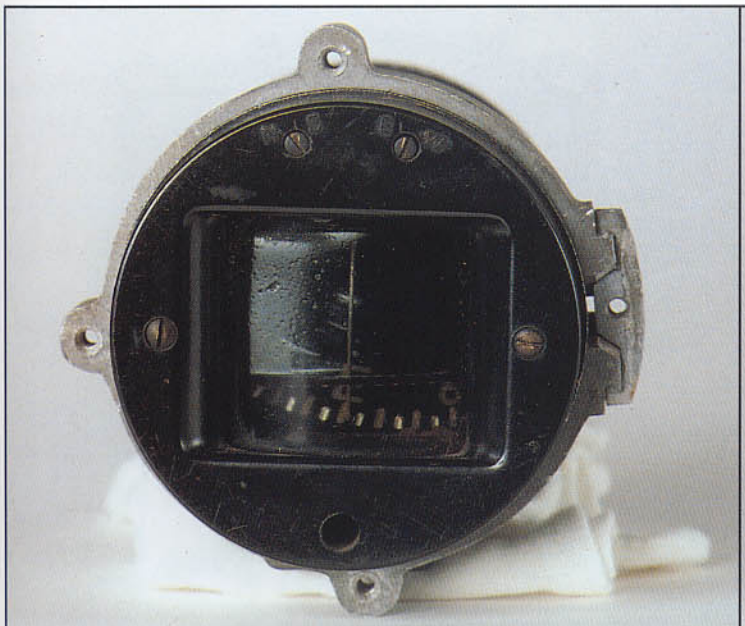


Artificial horizon made by Bauart licensed from Sperry.

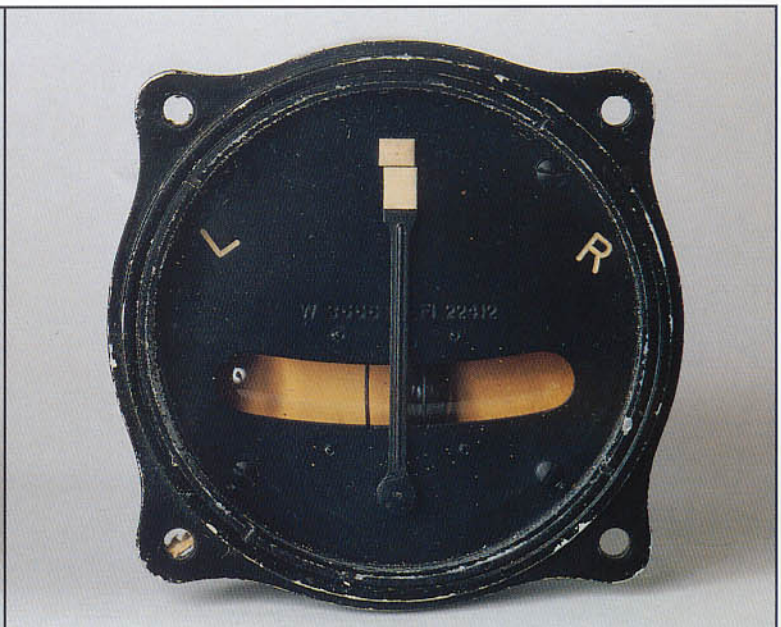
Combined artificial horizon + turn and bank indicator.



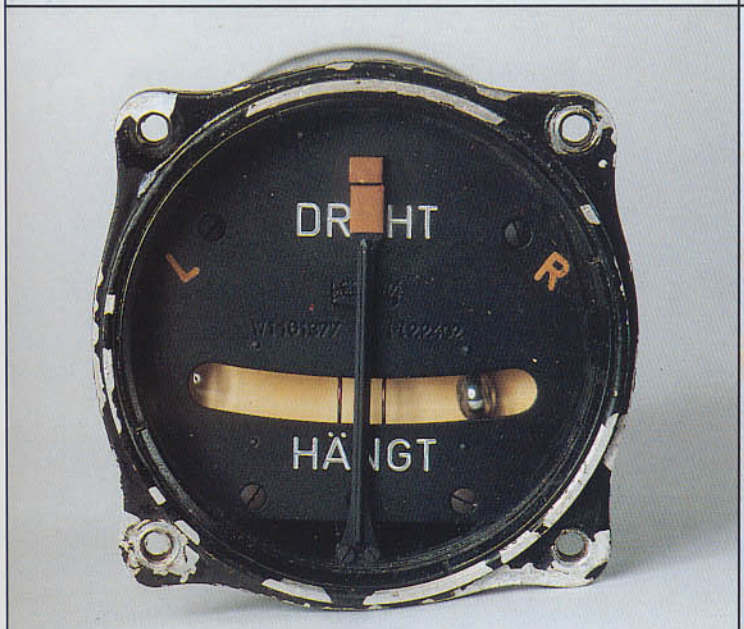
Coarse indicator of remote compass reading unit.



Oil filled magnetic compass (collapsed).

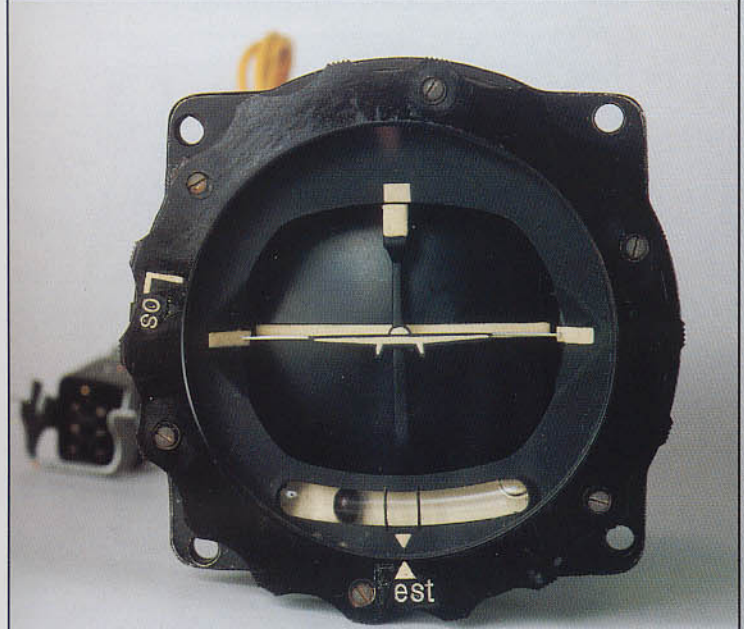


Turn and bank indicator.



Turn and bank indicator made by Askania.

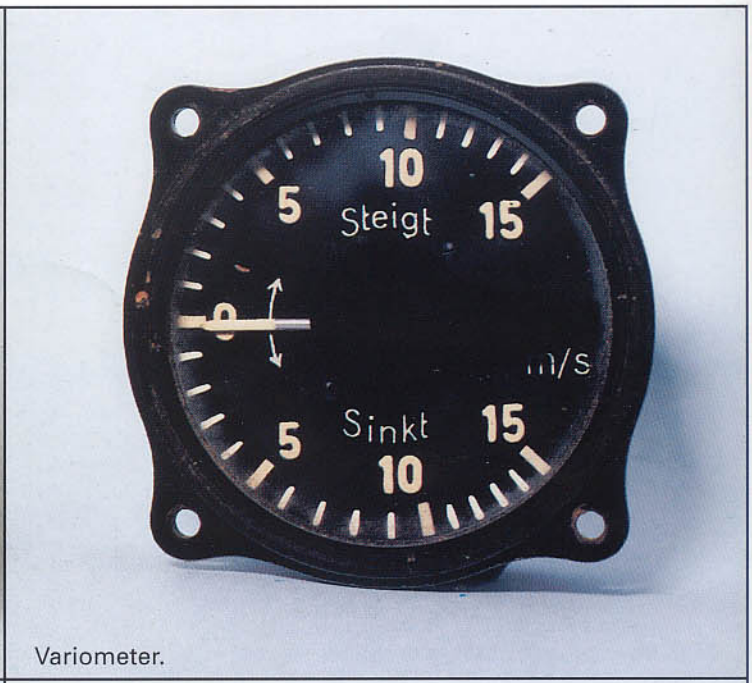
1935 Askania turn and bank indicator.



Combined artificial horizon + turn and bank indicator.

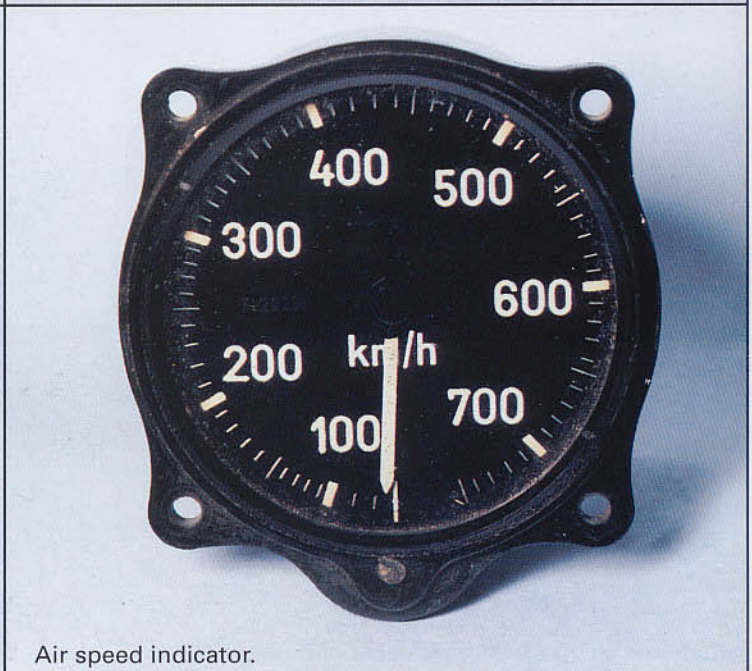
Fine and coarse altimeter.

Patin repeater compass.



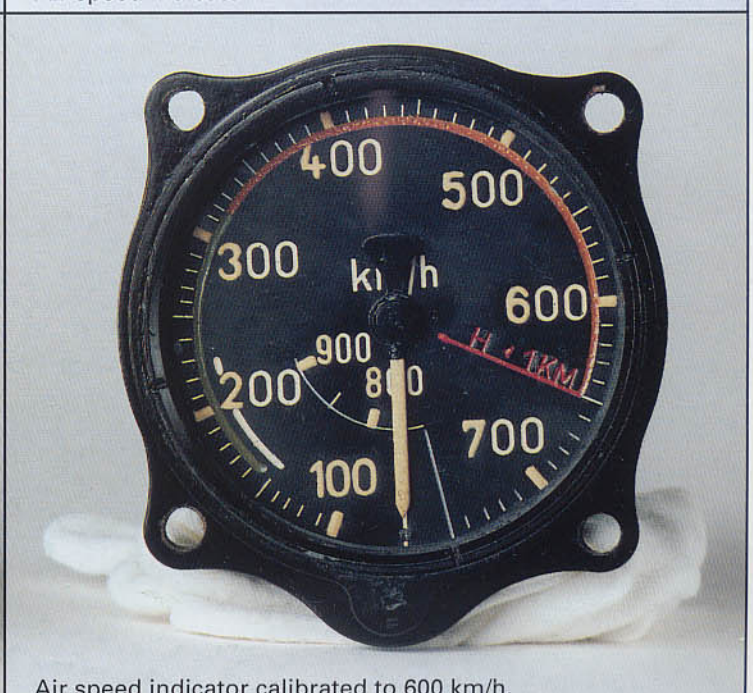
Variometer.

Fine and coarse altimeter.

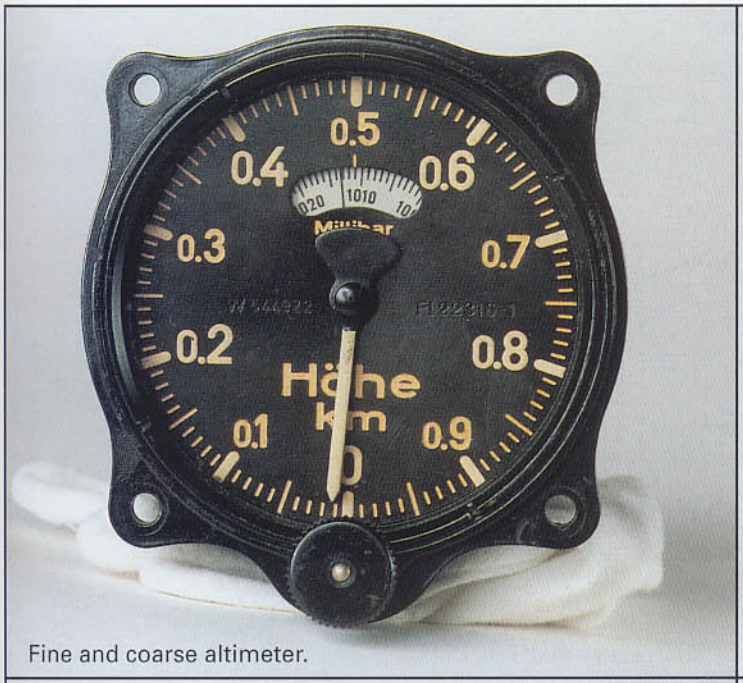


Air speed indicator.

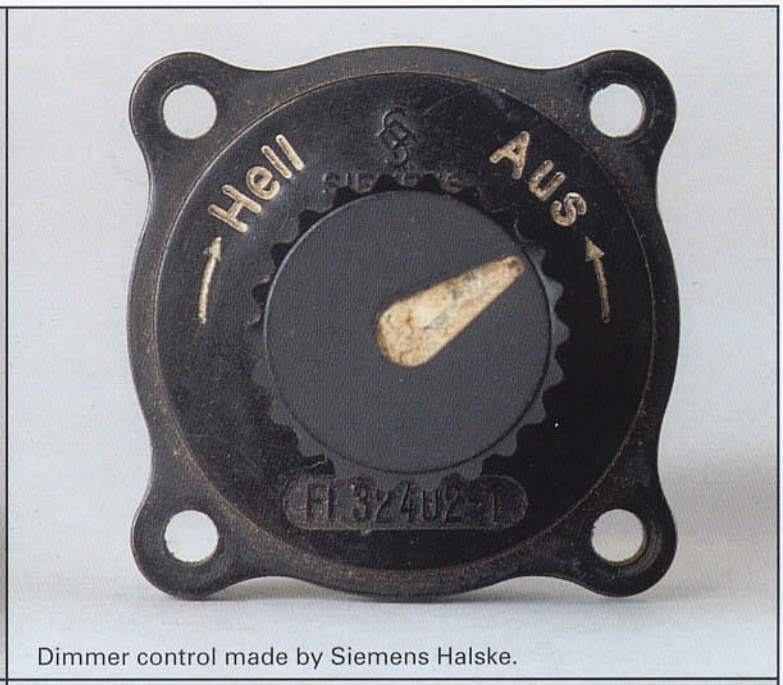
Variometer.



Air speed indicator calibrated to 600 km/h.



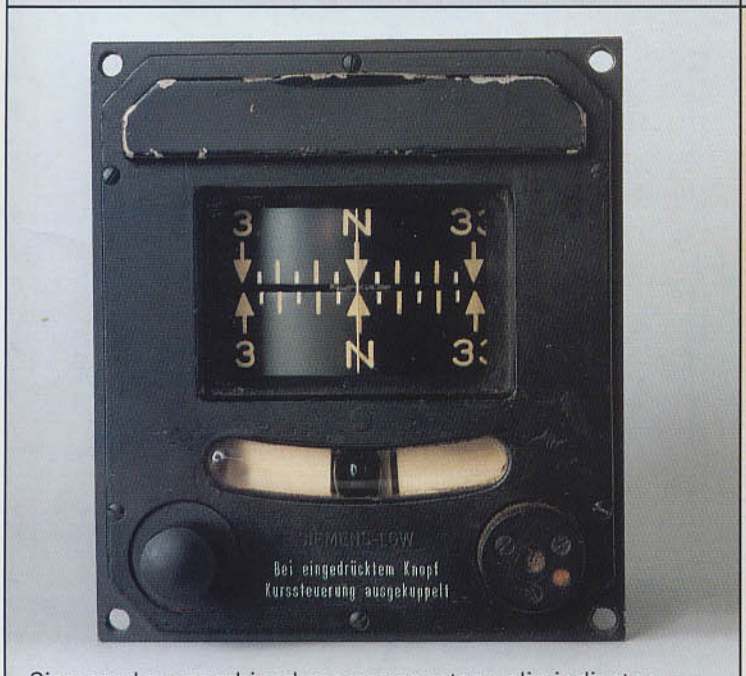
Fine and coarse altimeter.



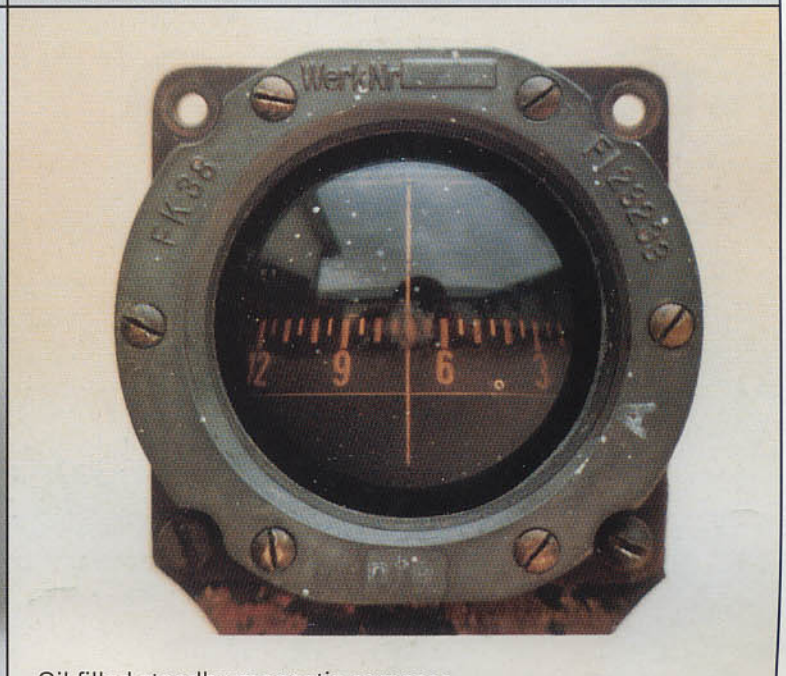
Dimmer control made by Siemens Halske.

Air speed indicator.

Air speed indicator.



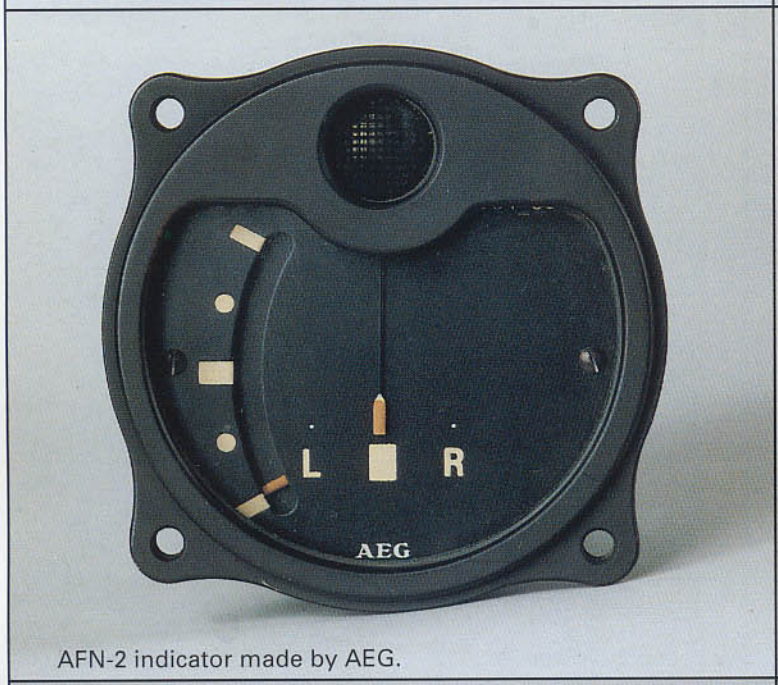
Siemens-Low combined coarse repeater + slip indicator.



Oil filled standby magnetic compass.

Patin repeater compass.

Variometer made by Ludolph.



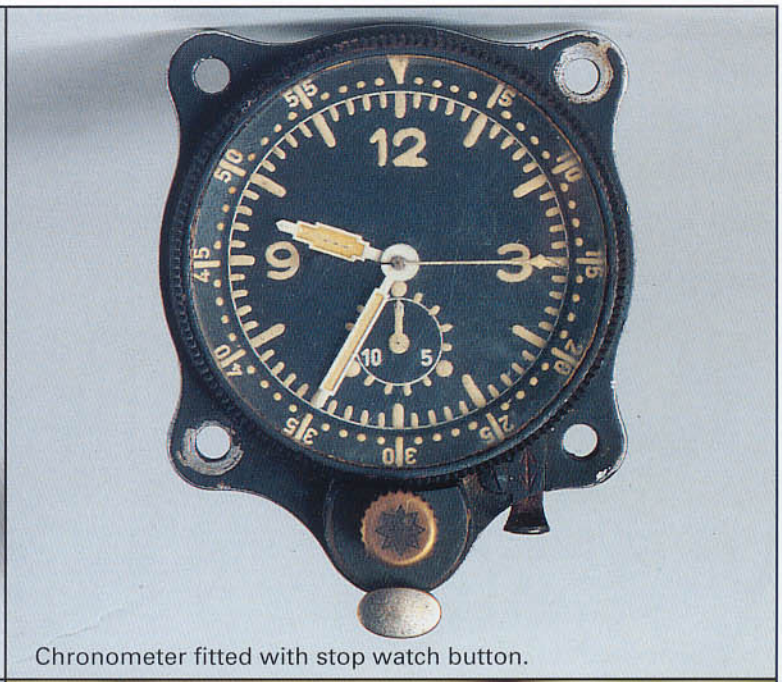
AFN-2 indicator made by AEG.

AFN-2 indicator.

Dimmer control made by Bauart Siemens.

Dimmer control made by Siemens.

Chronometer made by Kienzle.



Chronometer fitted with stop watch button.

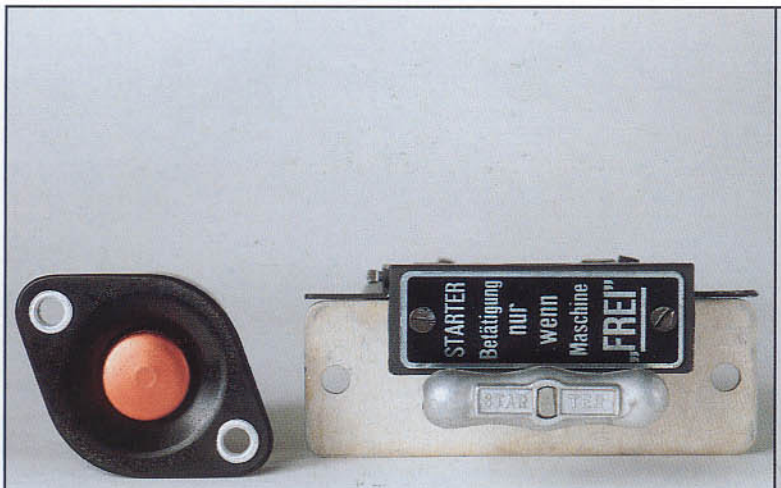
Chronometer.

FK 38 Magnetic Compass (F123233).

ENGINE INSTRUMENTATION

Engine instrumentation ranged from simple, single function items through to four differing forms of indication within one instrument. This had advantages where space considerations were paramount, especially with multi-engined aircraft. With a four-way indication, a single instrument could encompass fuel pressure *(Brenstoffdruck)*, oil pressure *(Schmierstoffdruck)*, coolant temperature *(Kühlmitteltemperatur)* and oil temperature *(Schmierstofftemperatur)*. For twin-engined aircraft this was sometimes divided into a simpler form whereby one instrument jointly attended to oil and fuel pressure for both engines simultaneously while a similar one attended to oil and coolant temperatures for both.

Engine instrumentation was usually grouped to allow ease of assessment, but as the war progressed military considerations were occasionally in conflict with this basic premise. With the advent of jet and rocket propelled aircraft, German instrument manufacturers were faced with a demand for a totally new range of engine instrumentation, a challenge they met with customary sophistication.



Master electrical cut-off (left) + engine starter pull handle.

Tachometer calibrated to 2400 rpm marked Original Bruhn.

Tachometer calibrated to 3000 rpm made by Deuta-Morell.

Original Bruhn tachometer calibrated to 3500 rpm.

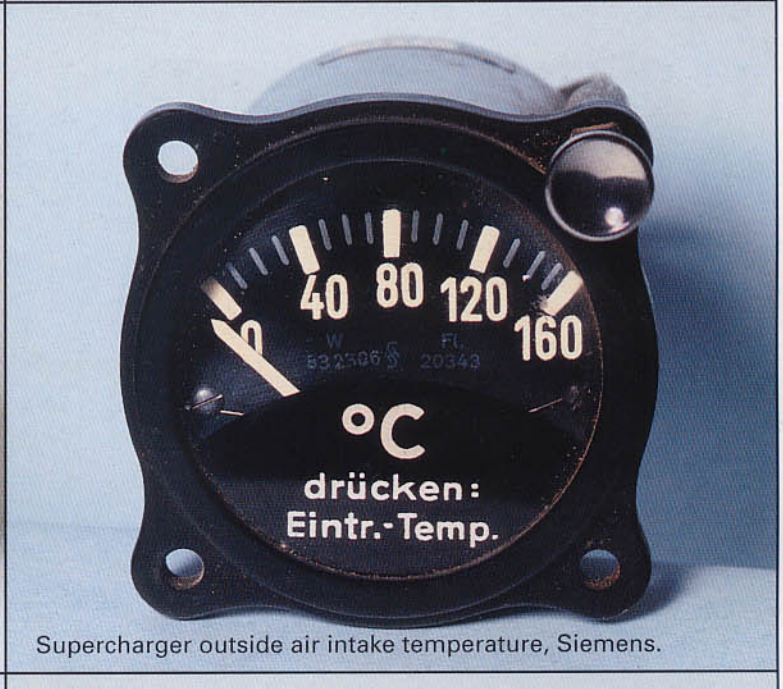
Tachometer calibrated to 3500 rpm.

Tachometer calibrated to 3500 rpm.

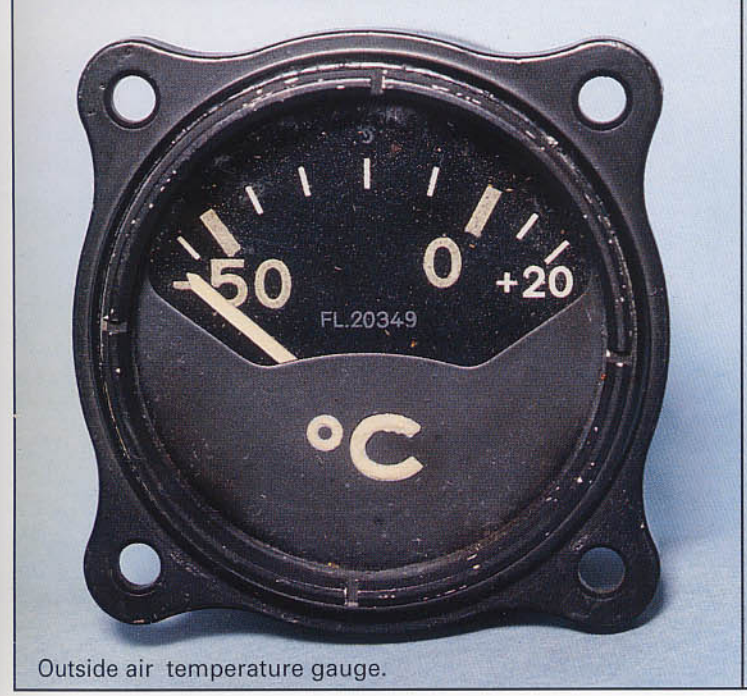
Manifold pressure gauge made by Askania.

Manifold pressure gauge.

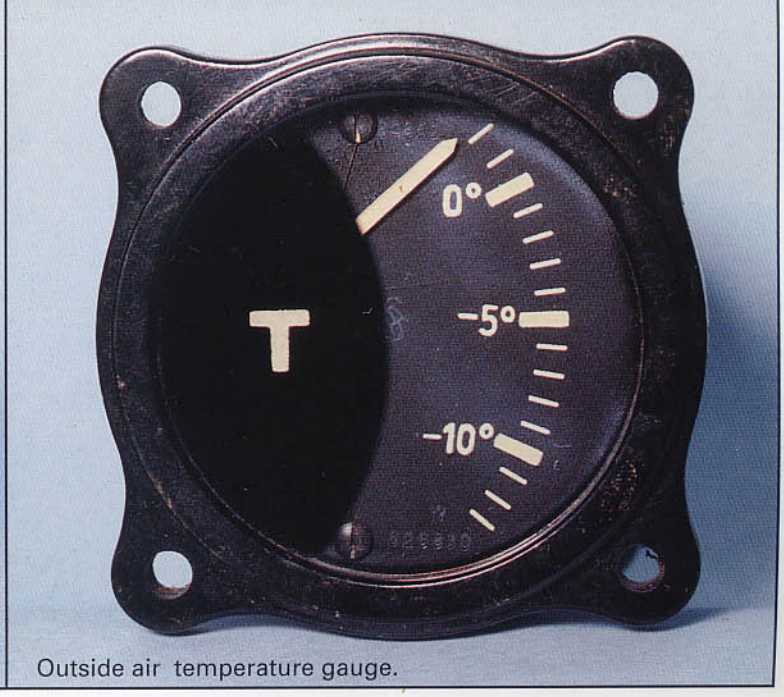
Manifold pressure gauge marked for combat power + restart.



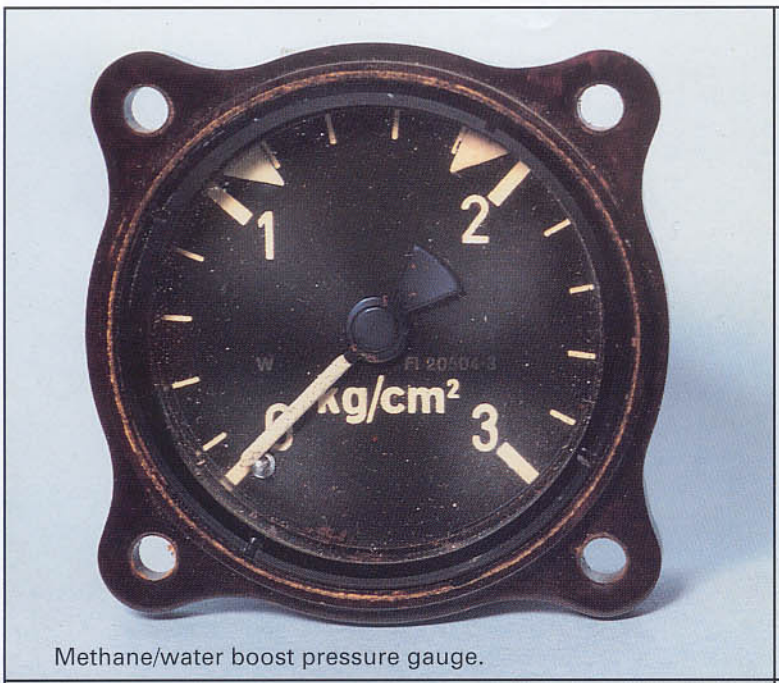
Supercharger outside air intake temperature, Siemens.



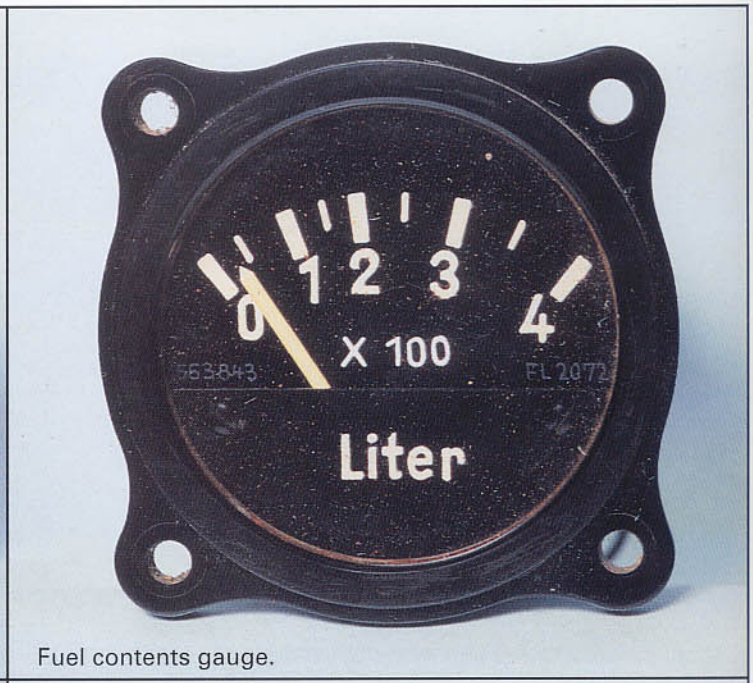
Outside air temperature gauge.



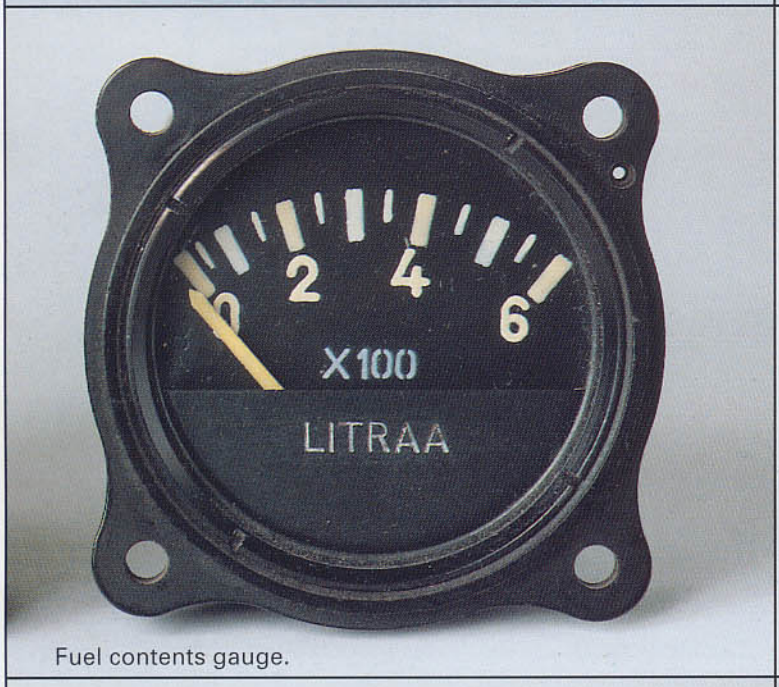
Outside air temperature gauge.



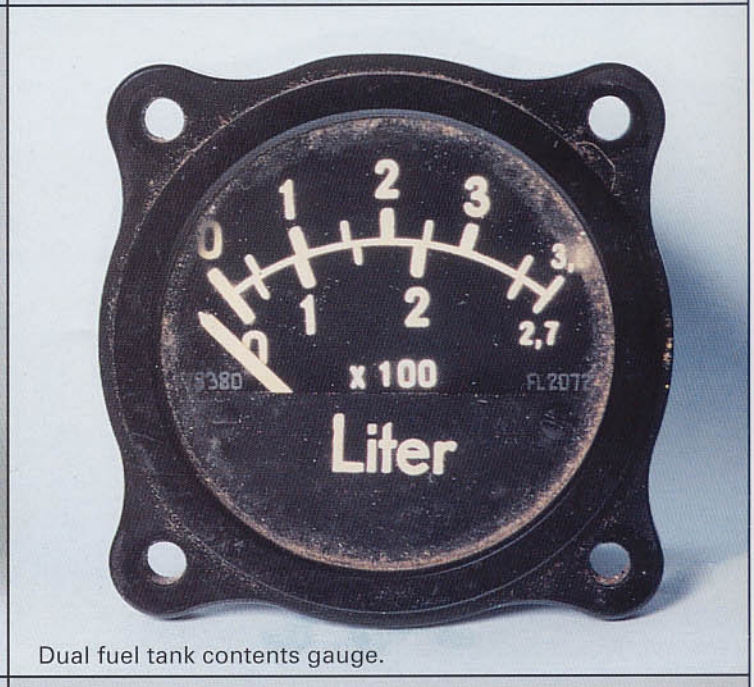
Methane/water boost pressure gauge.



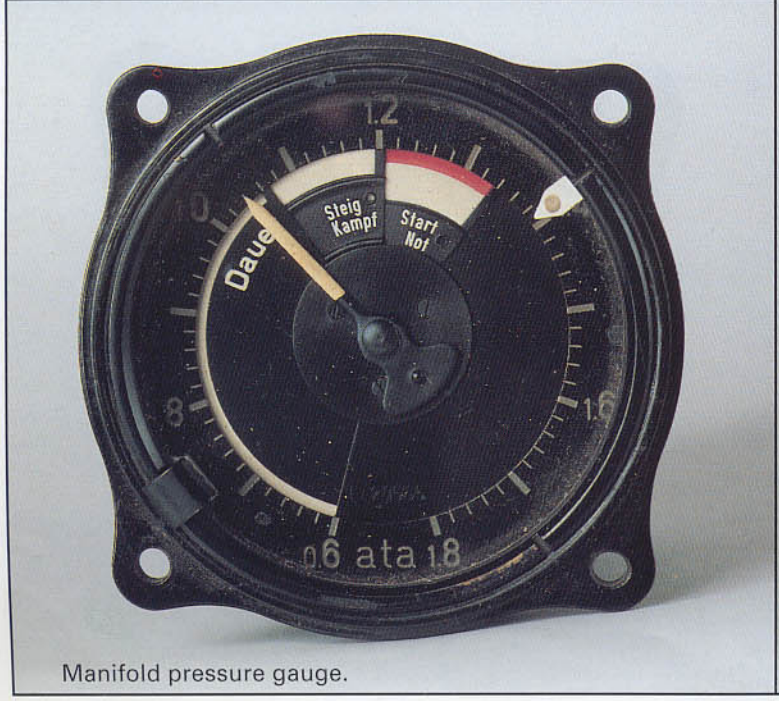
Fuel contents gauge.



Fuel contents gauge.

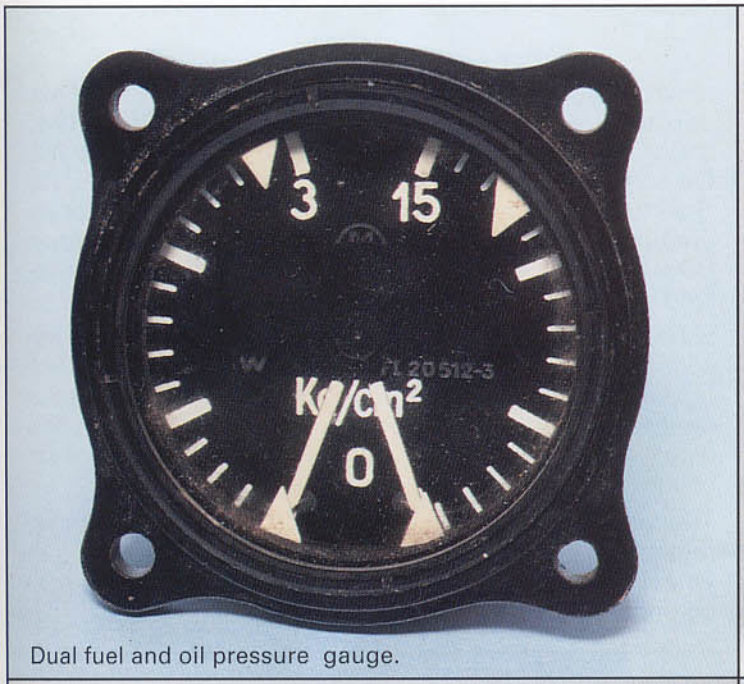


Dual fuel tank contents gauge.

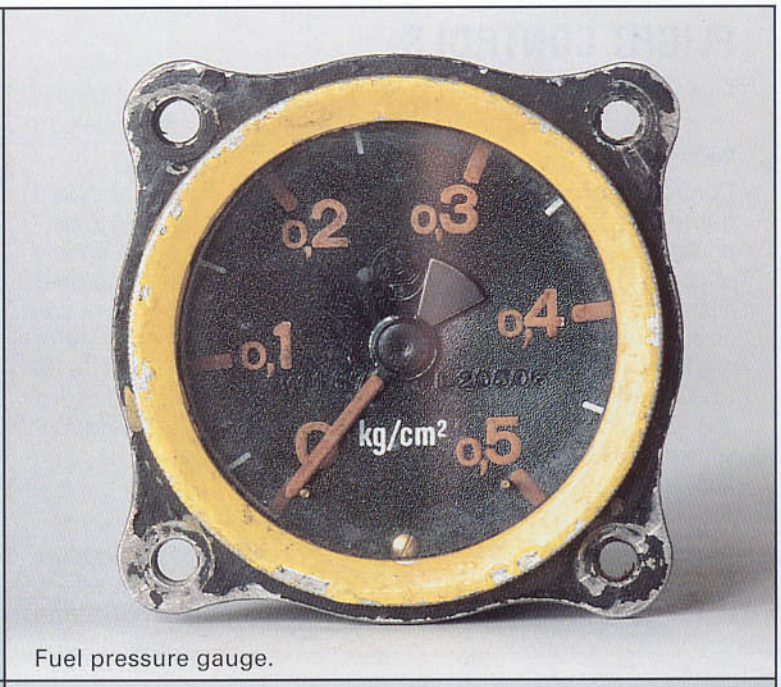


Manifold pressure gauge.

Dual fuel and oil pressure gauge.

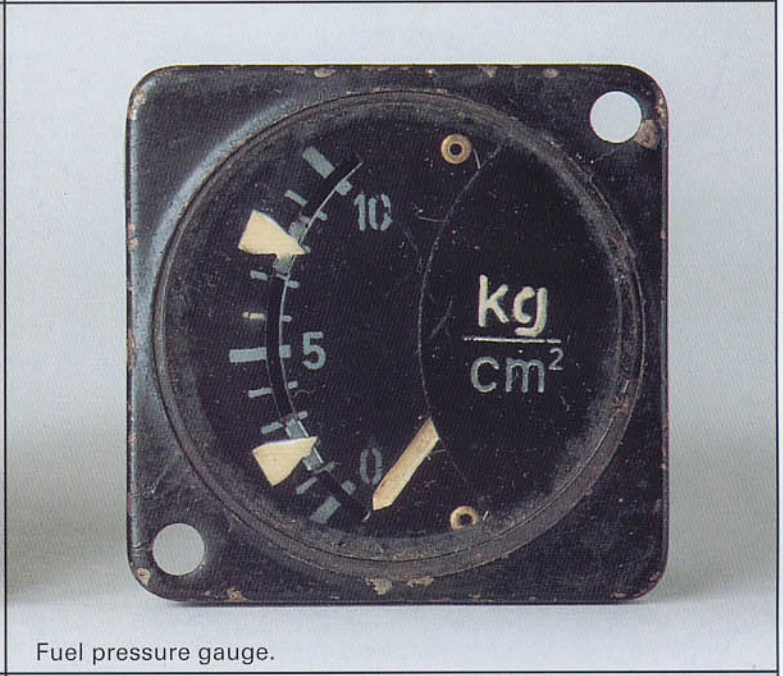


Dual fuel and oil pressure gauge.



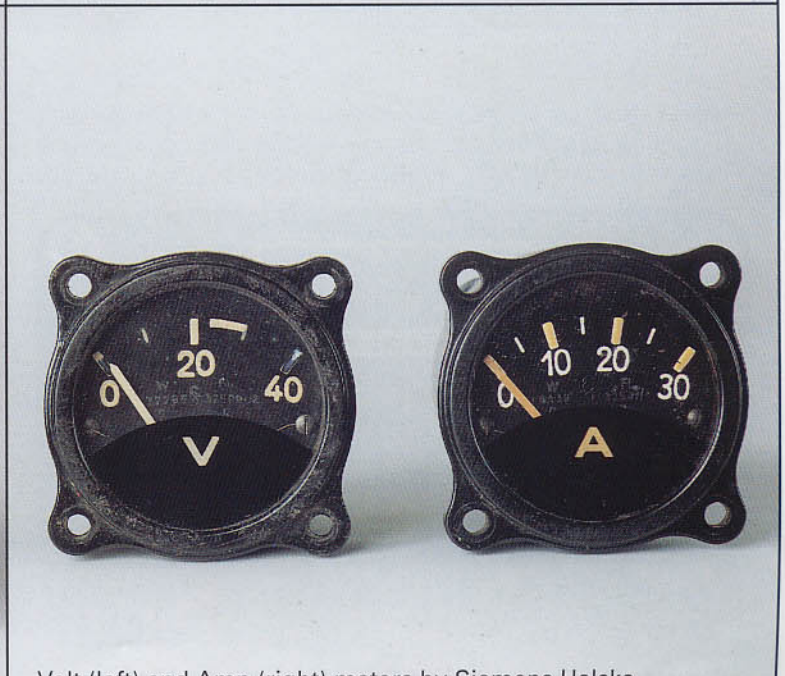
Fuel pressure gauge.

Oil pressure gauge.



Fuel pressure gauge.

Oil pressure gauge.



Volt (left) and Amp (right) meters by Siemens Halske.

FLIGHT CONTROLS

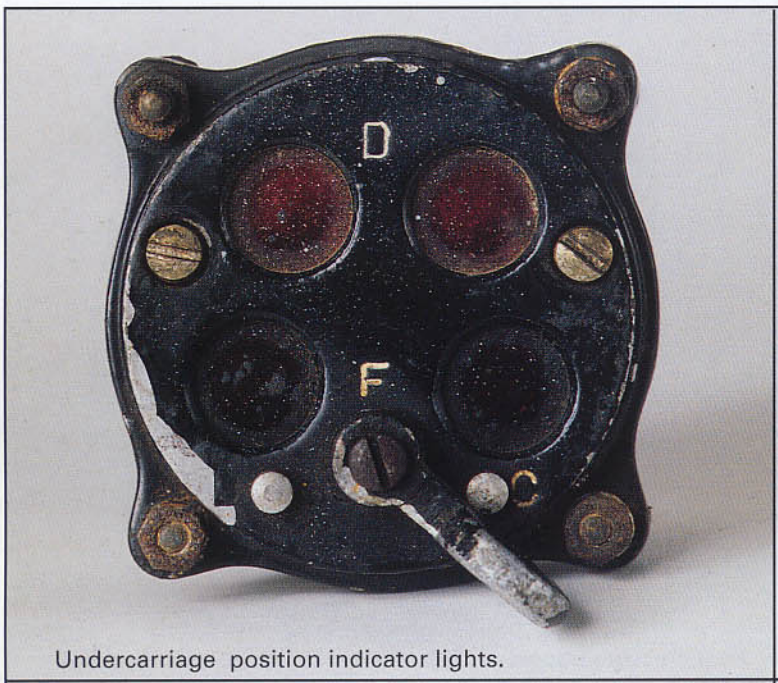
Fight controls covered a range of items from the actual control column, rudder pedals and trim wheel to flap and undercarriage selectors.

Control columns among fighter aircraft were of fairly standard design during the early stages of the war. The main differences were found in the grip, or head, which carried a variety of items specific to the particular aircraft design. With bomber aircraft (discussed in volume 2), the same type of control column tended to be utilized throughout the development life of the basic design or series (e.g. the Do 17 to Do 217 and Ju 88 to Ju 188). However, as the war progressed, aircraft designs altered and advanced; in some instances this lead to a distinct variation in control design features such in the He 219 night fighter (see volume 2).

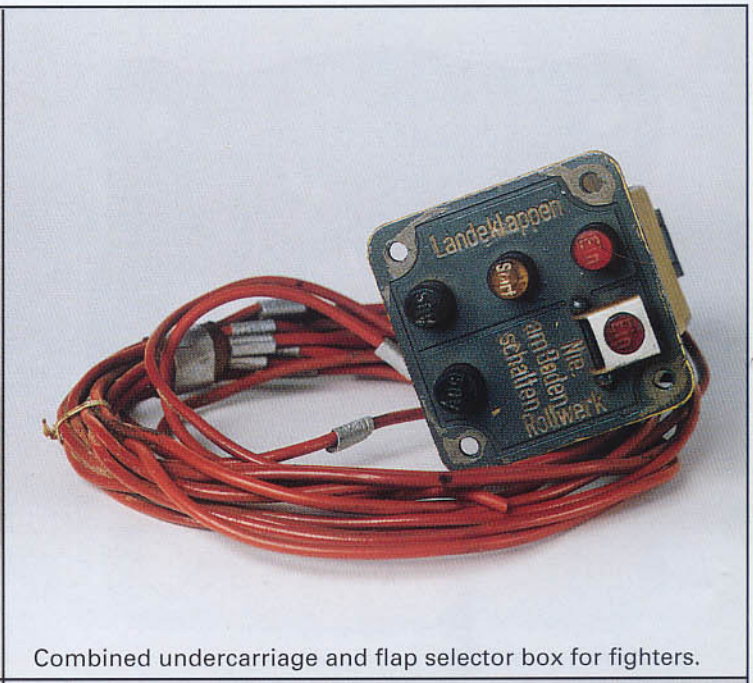
Rudder pedal design progressed steadily and gained in sophistication of form as the war progressed. The perforated steel sole plate design, with in-built brake controls, was used initially in the advanced bomber designs of the late 1930s and remained in widespread service until 1945. This form of rudder pedal was used also for fighter aircraft from 1940 onwards, culminating its use in this genre with the Me 262. On some smaller second line aircraft, such as the Fi 156 *Storch*, a lighter variety of rudder pedals was occasionally employed. The Me 163 B introduced a molded brown Bakelite design of simplified form very similar to the design utilized in the Bf 109 D, C and D series.

Sophistication also brought about change to such items as flap controls. Early, manually operated types used for the pre-war fighters and bomber were replaced by pneumatic varieties operated by a selector switch. On some aircraft designs, this type was replaced by an electrical system with a simplified set of button selector/operation controls.

The one item which seemed impervious to change, regardless of aerodynamic progress was the humble trim wheel. It remained virtually unaltered throughout the period under review.



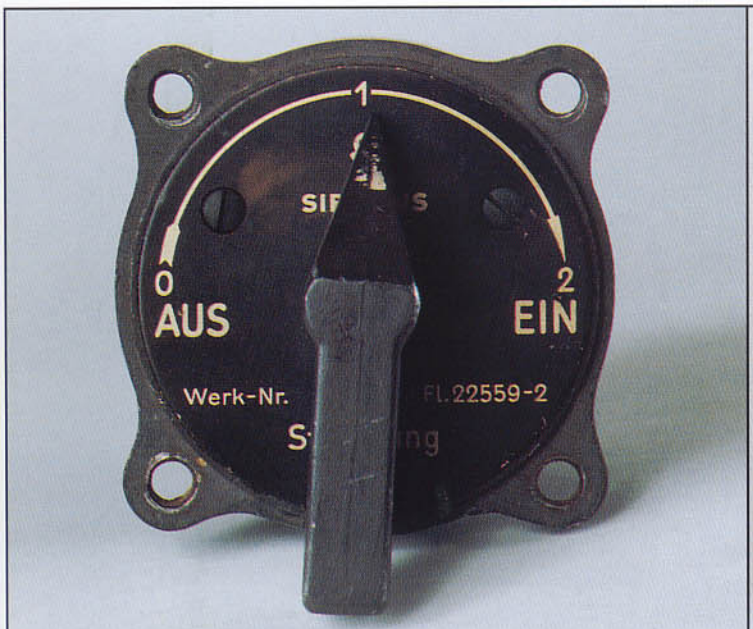
Undercarriage position indicator lights.



Combined undercarriage and flap selector box for fighters.

Combined undercarriage and flap selector box for bombers.

Undercarriage warning horn made by Bosch.



Auto pilot master selector switch made by Siemens.

Trim position indicator.

Propeller pitch indicator.

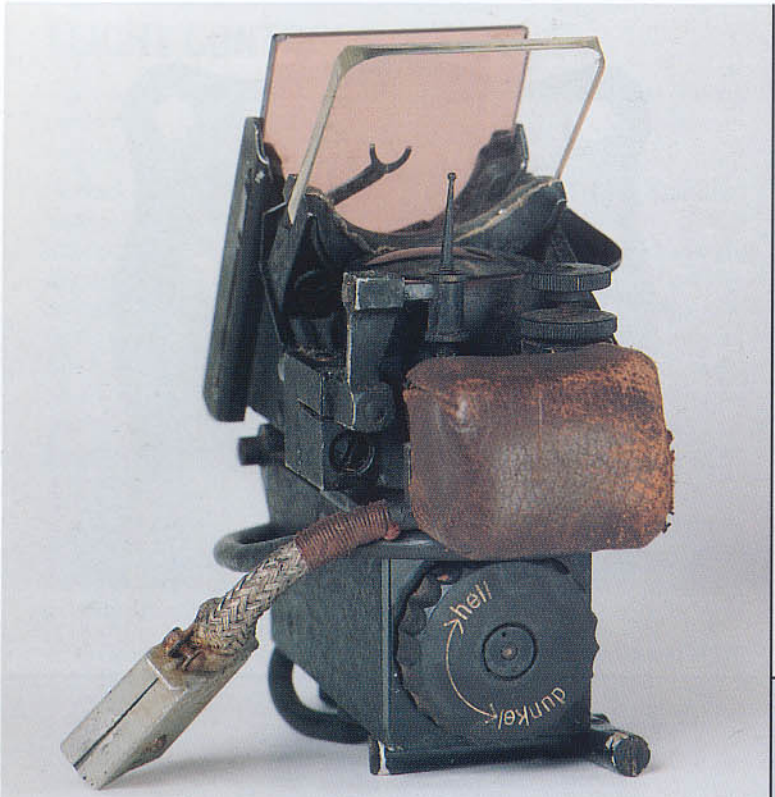
PFK/m (Fl. 23331) master compass.

WEAPONS SYSTEMS

Weapons systems ranged from the basic airframe-mounted armament of machine guns and cannon to disposable loads such as bombs and rockets. In each case a specialized control system was involved. For machine guns and cannons, an arming switch was fitted along with round counters to keep the pilot informed of his ammunition status.

When the fighter-bomber role was introduced, a sub-panel was fitted, to single-engined fighters which contained the arming switches and method of disposal, i.e. single weapon or multiple release. The fusing panel was designated *Zündschaltkasten* (ZSK) while the bomb release panel was designated *Abwurfschaltkasten* (ASK-R). These two abbreviations appeared suffixed by specific model numbers but their respective functions remained the same. In bomber aircraft, a much larger and more specialized bomb release/arming selector panel was utilized to handle the larger and more complex payloads.

The advent of rocket armament, carried by both single- and twin-engined fighter aircraft, saw no major change to the arming and fusing systems. Release of the ordinance on fighter designs was controlled by a button on the control column head. Where this addition was made in the field the wiring was external, running down the control column.



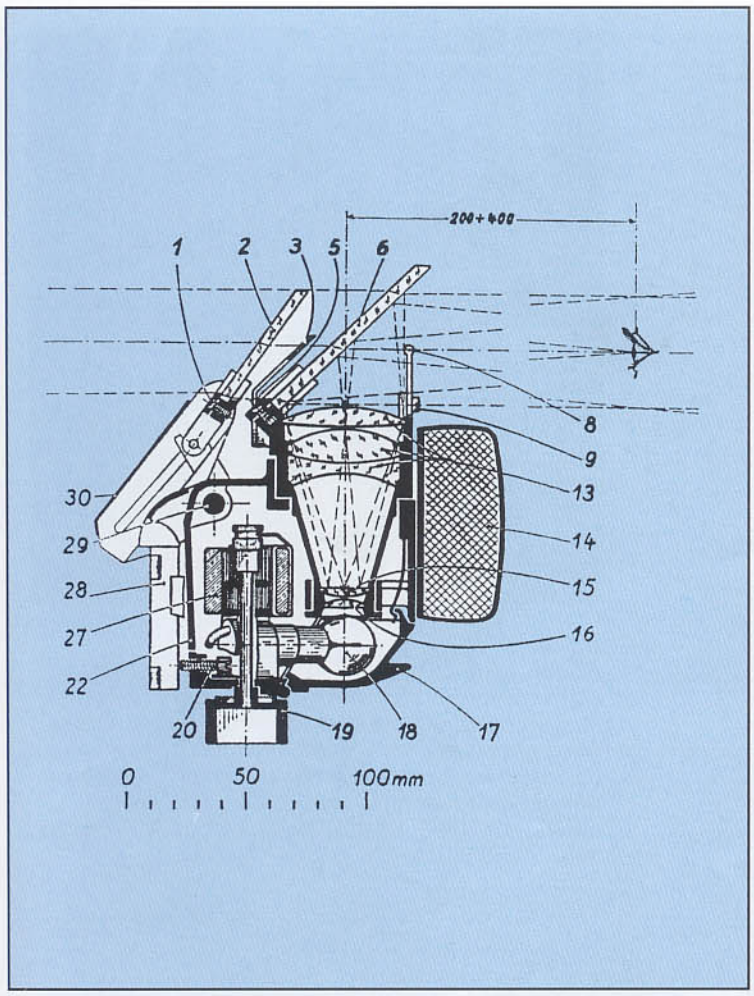
Standard Revi 3d gunsight.

Revi 16A gunsight.

Standard Revi 16B gunsight.

Revi 16A gunsight.

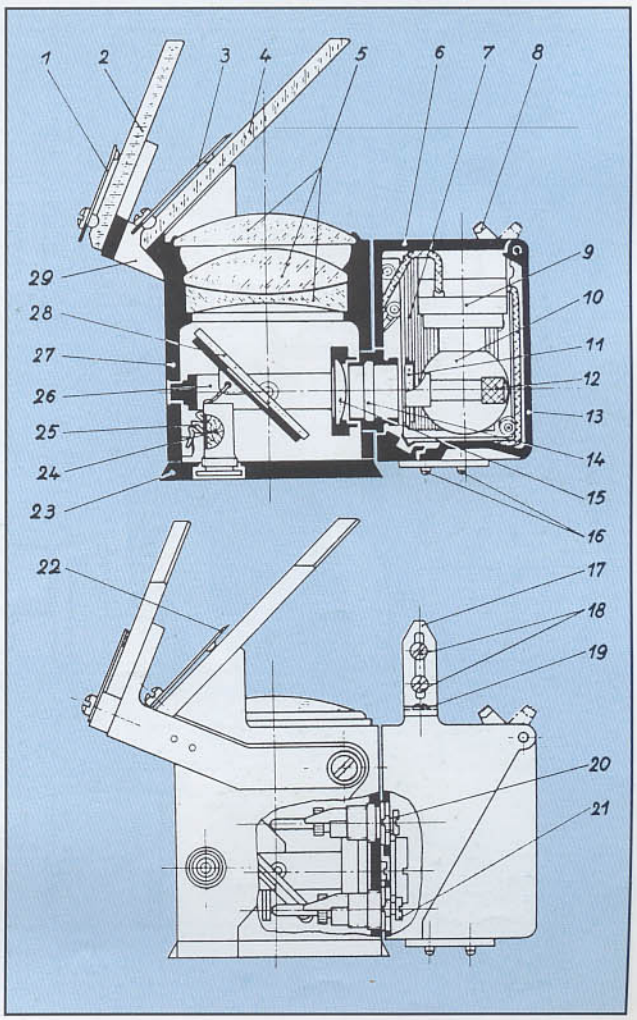
THm/44Kk turret gunsight.



Above: Standard German fighter gunsight during the early to mid period of the war, was the Revi C/12D gunsight.

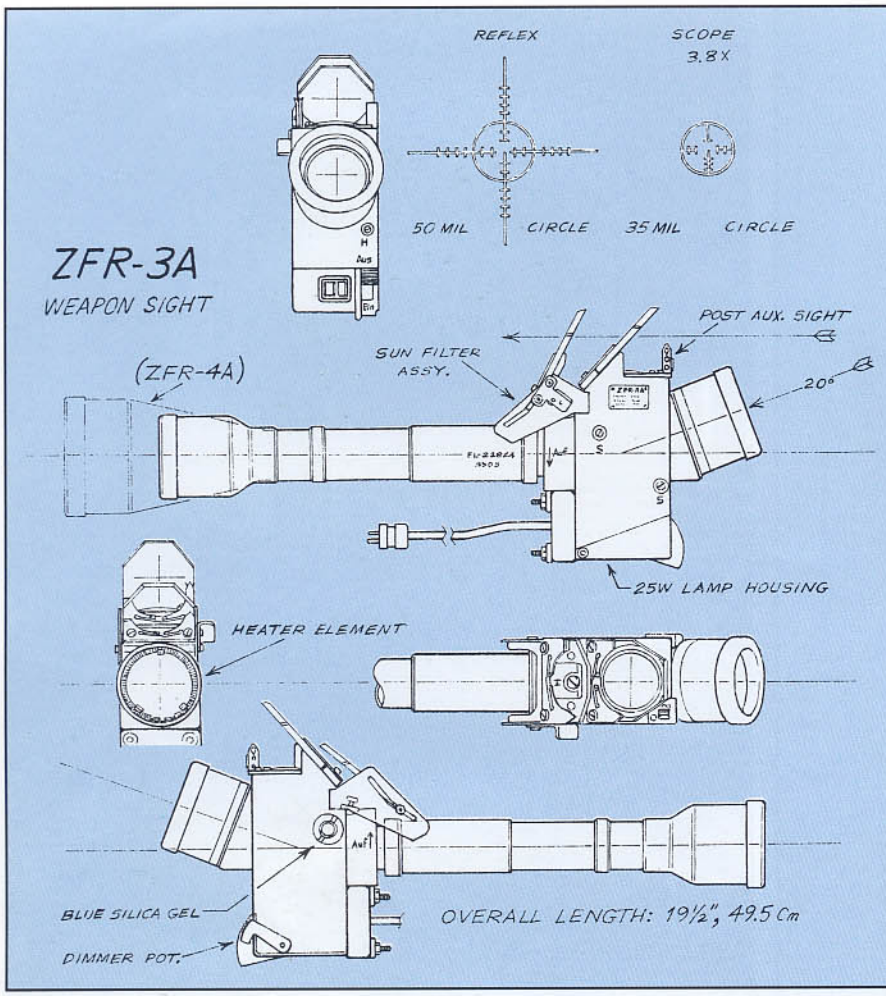
Above Right: Close-up of the Revi C/12D gunsight fitted to the Bf 109 G-6 owned by the National Air and Space Museum, Washington, DC.

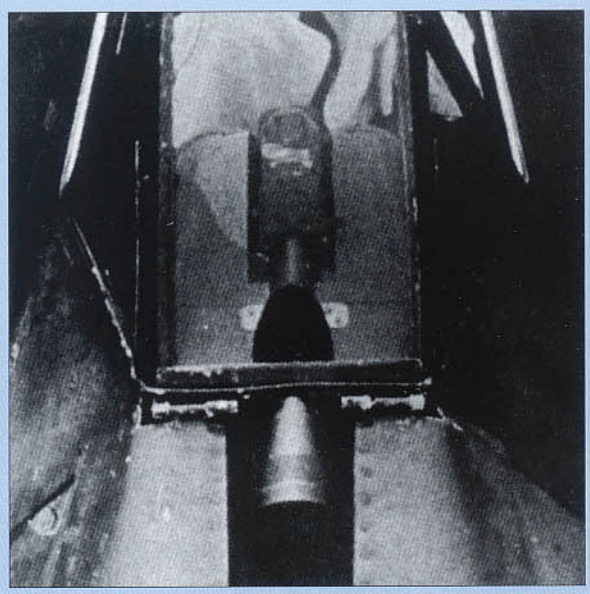
Right: The Revi 16B gunsight was another standard German fighter gunsight in service from 1943. This gunsight was fitted to many mid to late war German fighters such as the Focke-Wulf Fw 190 A-8.



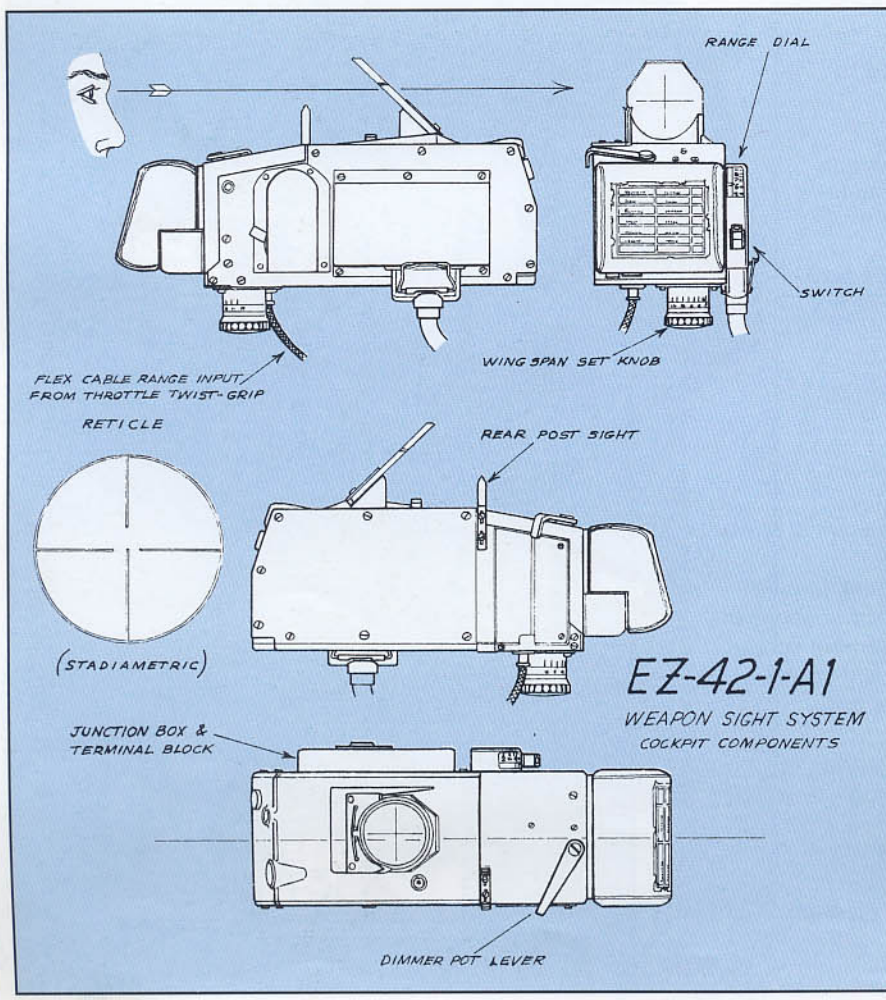
Revi 16B Key

1. Tinted glass retaining spring
2. Tinted glass plate
3. Reflector plate retaining spring
4. Reflector plate
5. Objective lenses
6. Light bulb housing
7. Dimmer rheostat
8. Dimmer switch
9. Bulb holder
10. Light bulb
11. Night filter
12. Filter switch
13. Bulb housing cover
14. Non-reflective glass cover
15. Sighting image lens
16. Spring-loaded electrical contacts
17. Blade rear sight
18. Vertical adjustment screws
19. Horizontal adjustment screws
20. Horizontal adjustment screw
21. Vertical adjustment screw
22. Post-type front sight
23. Base plate
24. Silica crystal capsule
25. Adjustment spring
26. Cardan mount
27. Lens chamber
28. Mirror
29. Tinted glass swing support arm

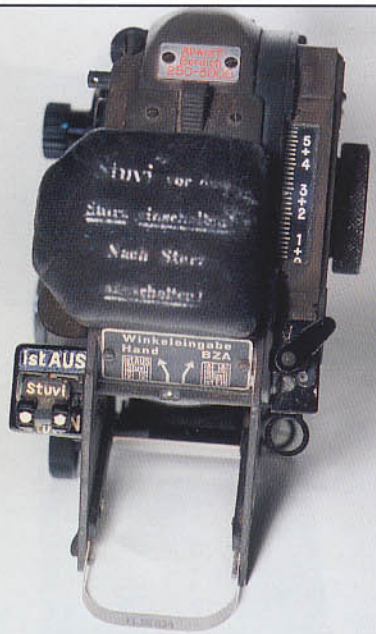




Above: The ZFR-3A and ZFR-4A telescopic gunsights (Zielfernrohr) were used to identify distant aircraft normally out of clear visual range. These gunsights were not universally fitted to production fighters, but were, instead, tested on a number of types including the Fw 190 A-8 (shown above), Bf 109 E, Bf 110 C and the high altitude BV 155.

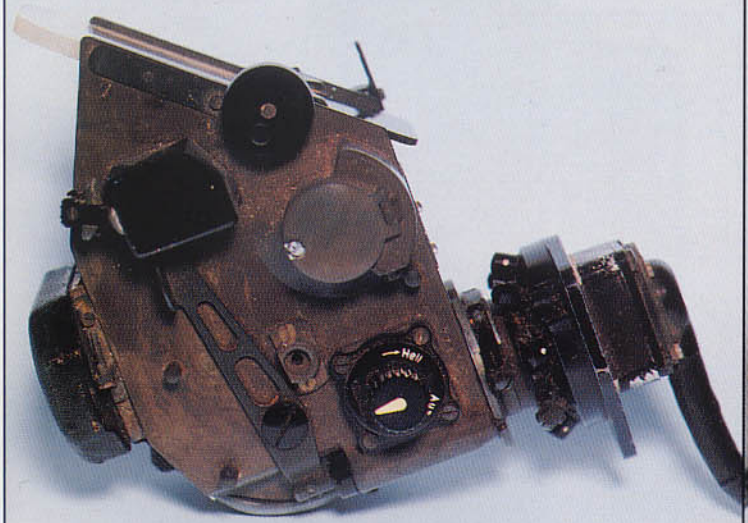


Above: The EZ 42/1-A1 gyroscopic gunsight (EZ - Einheitszielvorrichtung / Standard sighting device), manufactured by Askania, was introduced late in 1944 and intended for fighters such as the Ta 152, BV 155 and the Me 262 (shown above).

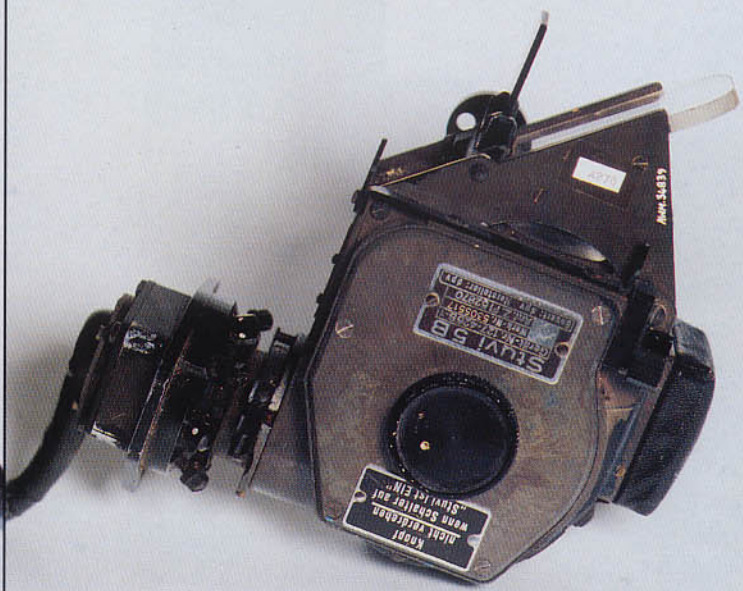


Stuvi 5B periscopic dive bombing sight.

Stuvi 5B sight with the amber sun screen in position.



Right hand side view of the Stuvi 5B.



Left hand side view of the Stuvi 5B.

Rear view of the Stuvi 5B

Partly stripped-down KG 13B control column head.

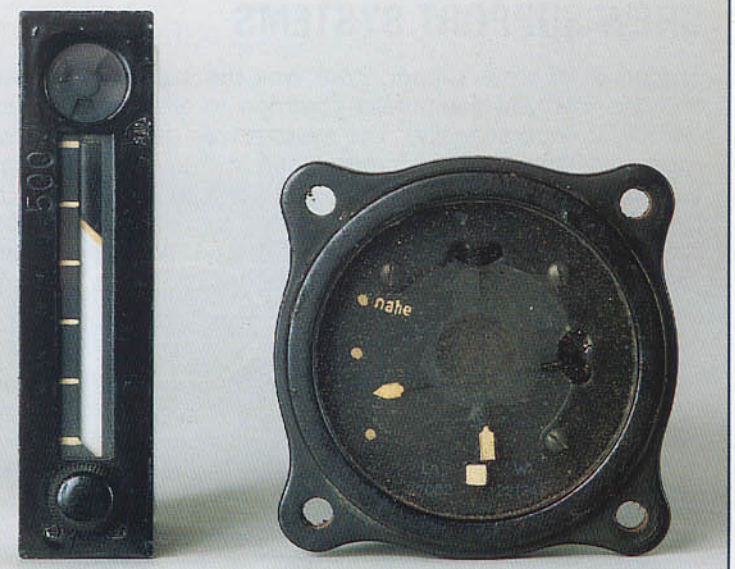
Port side view of Bauart made KG 13B control column.

Starboard view of KG 13B showing microphone button.

Close-up of KG 13B base showing electrical connection.

Control head of KG 13A unit for a Bf 109 G-10/U4.

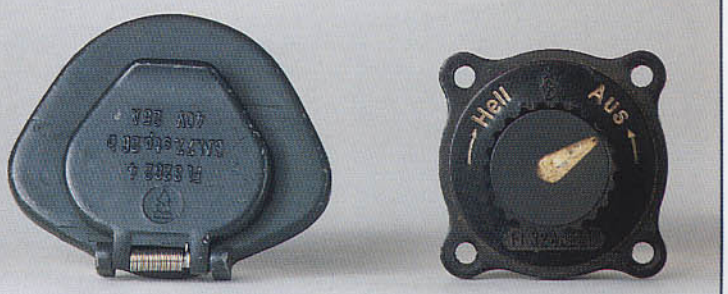
Control column head from Ju 188 top turret.



Ammunition round counter (left) + armament instrument.

Bomb selector panel.

Ammunition round counter.

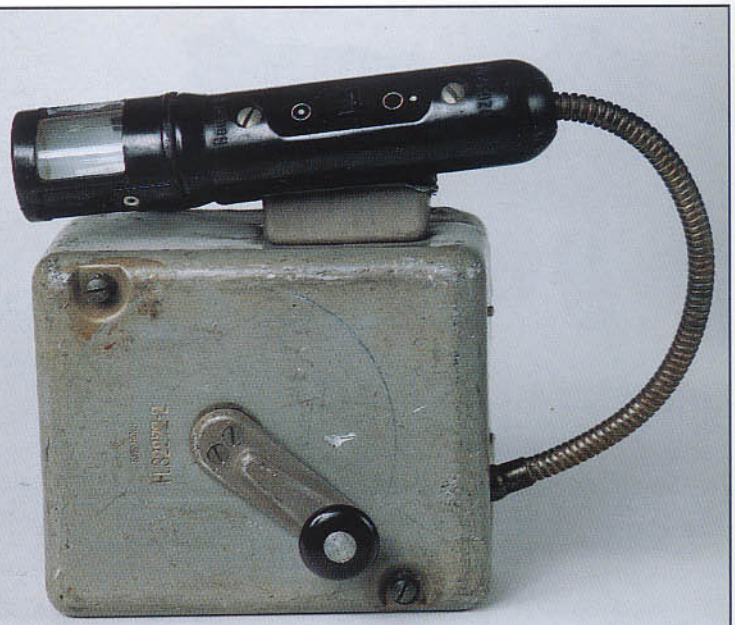


Bauart Siemens power socket for gunsight + dimmer switch.

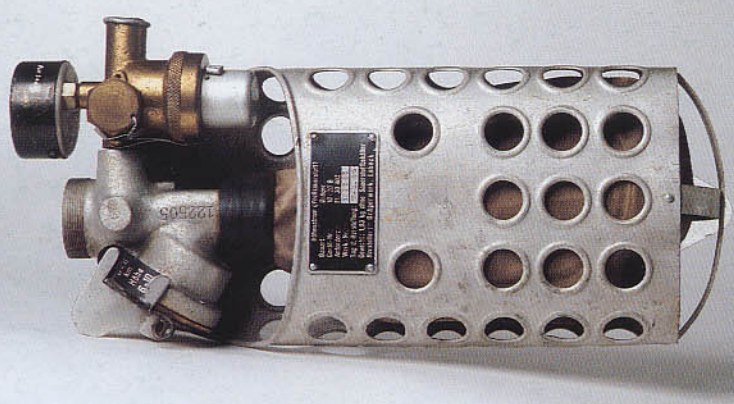
CREW SUPPORT SYSTEMS

The principal crew support item was the supply of oxygen and this involved equipment common to all classes of aircraft flown operationally. The system was designed in four main parts; the oxygen storage (done in spherical metal bottles and color-coded in Color 24 Blue with two stripes in Color 21 White, around each bottle), a regulator canister with a manual valve control (usually painted blue), a demand valve (also color coded in blue and white) and finally the oxygen mask. Oxygen was usually used at altitudes above 10,000 feet (3,000 m).

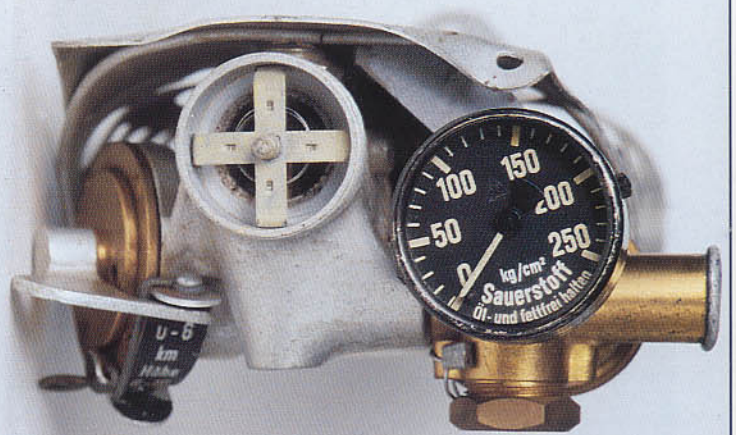
Heating in German aircraft, unlike their British counterpart which used a heat exchanger to warm the air of the main crew positions, was usually done by means of electrically heated flying suits and boots.



Flexible light unit by Siemens Halske.

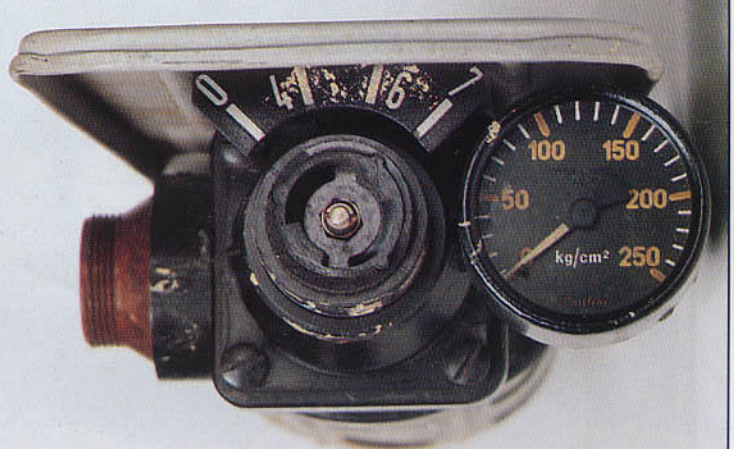


Oxygen regulator unit introduced in the mid-1930s.

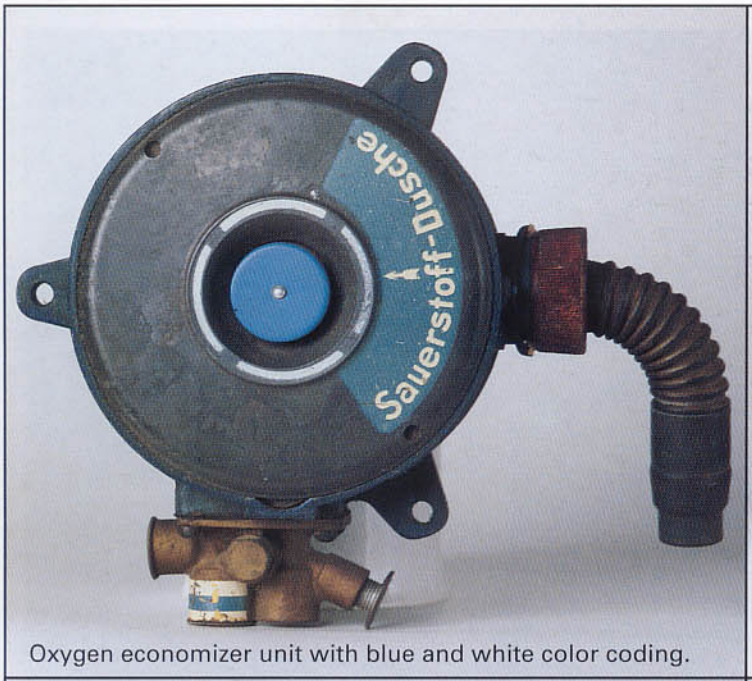


Late war oxygen regulator of more compact design.

Top view of oxygen regulator showing the pressure gauge.



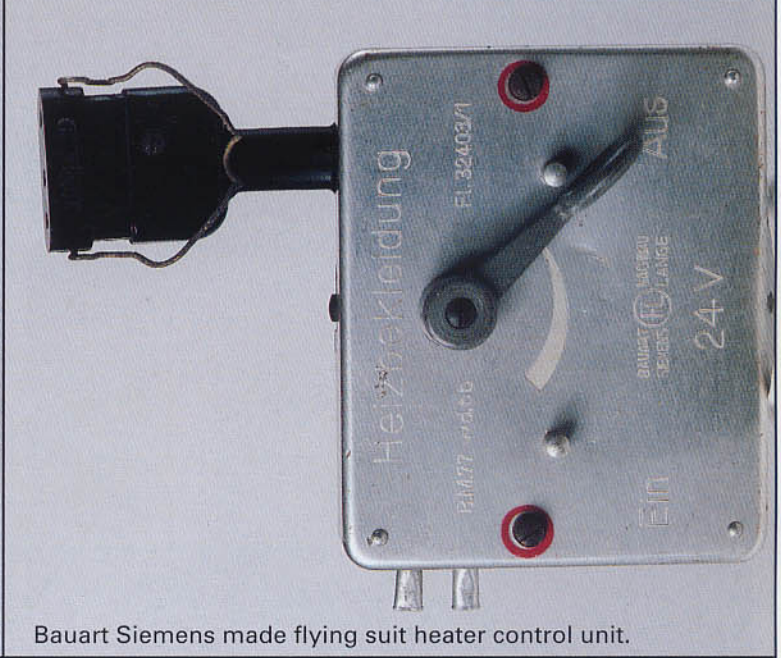
Top view of late war oxygen regulator.



Oxygen economizer unit with blue and white color coding.

Oxygen flow indicator (left) with its pressure gauge.

Oxygen flow remote control valve. Note color coding.



Bauart Siemens made flying suit heater control unit.

GERMAN FLYING SUITS By Glen G. Sweeting

Fine quality protective clothing, to be worn over the service uniform, was issued to all flying personnel. The individual's military rank was indicated by special insignia sewn on both upper arms. The summer flying suit, Type K So/34, was a coverall of brown-flecked impregnated cotton lined with twill. This model had zippers on the front, sleeves, pockets and other locations. The summer flying helmet, Type FK 34, was a close-fitting model made of fabric similar to the suit, and might be lined or unlined. Type Lkp S 53, manufactured by Siemens, was similar but featured brown leather-covered earphones with a throat microphone. Type Lkp 100, another flying helmet, also featured a throat microphone. Summer helmet, Type Lkp S 101, featured insect netting over the crown and brown leather over the earphones. The winter flying suit, Type KW 1/33, was made of gray-blue fabric with sheepskin or velveteen lining and a black fleece-covered collar. This flying suit could have either a button or zipper front. The Winter flying suit, Type KW s/34, was similar but made of brown calf leather lined with sheepskin and was primarily intended for use over water. Another winter flying suit, a two-piece electrically heated suit, was available in brown or black leather or gray-blue fabric. Winter flying boots, Type Pst 3, were of heavy suede, fleece-lined and could be worn with any outfit. An electrically heated version was also available. Flight jackets, of fabric or leather, were available in a variety of styles and colors, all with a zipper front. The winter flying helmet, Type K/33, was brown leather and fleece-lined. Fitted with earphones and a throat microphone, it was known as the Type Lkp W 53. A special crash-helmet, introduced in 1941, featured steel plates covered with brown leather and a special padded comb on top. This fleece-lined helmet was usually worn over the standard flying helmet by aircrew, including jet pilots, late in the war. Aviator goggles, Type Degea 295, were produced by Leitz and were of conventional design. Shatterproof goggles, produced by the firm Nitsche u Günther, were small oval frames of plastic without cushions. Lenses could be clear or tinted. The *Luftwaffe* was first to utilize a demand-type oxygen system for flights over 13,123 feet (4000 m). The Draeger H La 732 and the similar Auer A 824 both had rubber face pieces and hoses with thin, soft leather lower chin and cheek covers.

Opposite top left: A *Luftwaffe* officer wearing flying suit Type K So/34 with winter flying boots Type Pst 3.

Opposite top right: A Bf 110 gunner in winter flying suit KW 1/33, summer flying helmet LKp 53, Degea 295 goggles and pneumatic lifevest Swp 734. Hanging on his front is a demand oxygen mask. In his right hand is a winter flying helmet LKp W 100 and parachute 30 I.

Opposite lower left: Enlisted pilot wearing winter flying helmet LKp W 53, Degea 295 goggles and the Draeger H La 732 oxygen mask.

Opposite lower right: Rear gunner wearing crash-flakhelmet sometimes mistakenly listed as the "jet pilot's helmet."

Above: Heinkel 177 pilot and co-pilot both wearing summer flying helmets LKp S 100. Pilot has shatterproof goggles and a harness with central connecting box for parachute 30 I, worn over winter flying suit KW 1/33.

Right: German 27mm flare pistol, shown here in position in an Arado 234 B-2.

CHAPTER 2

DAY FIGHTERS 1935 – 1939

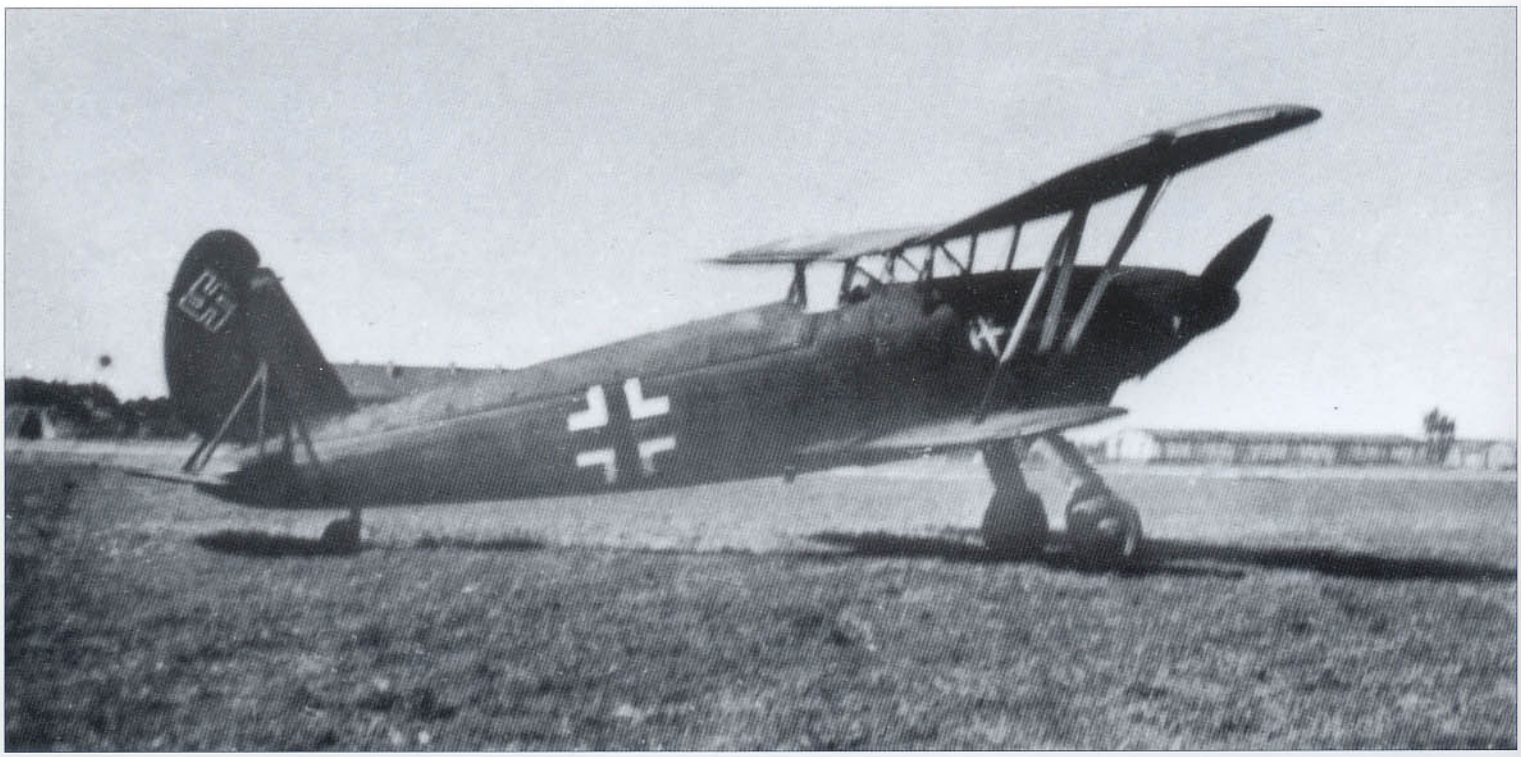
Arado Ar 68

In March 1935, the existence of the new German Air Force *(Luftwaffe)* was officially announced to the German people. From that point on, all efforts to mask the reason for being were cast aside in the headlong race to re-arm. The development and production of fighter aircraft received top priority in the new Third *Reich*. The German aviation industry responded to the challenge by producing aircraft of significant importance to the needs of the State. Firms such as Arado, Focke-Wulf, Heinkel and Messerschmitt lead the way. In the following pages we present examples from each of these companies. Some were more successful than others, but all were primarily designed to be fighters. In keeping with the introduction of the new German Air Force, the State Ministry of Aviation, the *Reichsluftfahrtministerium (RLM),* established a simple uniform system of aircraft designations based on an alpha-numeric format without regard to classification, mission or type. The numbers ran sequentially from 10 onward (the number 635 is the last known number officially employed). Each firm had its name shortened to a two- or three-letter prefix; e.g., Arado became Ar. The Arado Company first received a block of numbers in the new system beginning with 64 and extending to number 69, inclusive. Focke-Wulf received numbers 43, 44 and 47, while Heinkel's first number assignment was 42, 45 and 46. The first numbers allocated to Messerschmitt were 108, 109 and 110. Occasionally, numbers were reassigned to a different manufacturer, but this practice was generally discouraged. However, by 1942 the RLM did reassign certain numbers to new aircraft types if (a) the number had not been taken up by the host firm, or (b) if the development of a particular type had run its course. Prototypes and production aircraft were differentiated by the use of suffix letters and numbers. In the early days of the *Luftwaffe,* prototypes were often identified by lower-case letters, but these soon gave way to a simpler format involving the letter "V" for *Versuch* (test), followed by a number without hyphen. The first aircraft design selected for production usually began with the letter "A," followed by a hyphen with number. But, there were exceptions. In our discussion of the Ar 68 to follow, the reader will note that the first production version for this design was the E-series. This anomaly becomes understandable when we see that the fifth prototype, the Ar 68e, was the first variant selected for series production. Concurrently, and in compliance with Air Ministry regulations, the Ar 68e was officially redesignated Ar 68 V5.

The sleek lines of the Ar 68 were a familiar sight in the skies of Germany during the early days of the *Luftwaffe*. This single-seat fighter, produced by Arado *Flugzeugwerke* GmbH of Warnemünde, was the last biplane fighter employed by the German air force. It was a development of the firm's Ar 65, an early 1930s biplane design which held the distinction of being the first single-seat fighter to enter service with the newly established *Luftwaffe*. The Ar 68 was larger than its predecessor, but possessed exceptional handling qualities, in spite of the fact that early prototypes suffered from being under-powered. Its designers had hoped the new Arado fighter would replace the Heinkel 51 then in active service with the Luftwaffe. Five prototypes of the Ar 68 were built, the Ar 68a through Ar 68e, with the first principal production fighter being the Ar 68 E-1. This series of fighters was powered by the Junkers Jumo 210 Da engine, giving the fighter a top speed of 190 mph (306 km/h). The Arado firm believed their new fighter was superior to the Heinkel He 51 (see p. 40) and, to prove their point, asked Ernst Udet (State Inspector of Fighter and Dive-Bomber Pilots) to pilot the Ar 68 V5 in simulated combat with a standard production He 51 A-1. After a few minutes there was no doubt which fighter turned the better performance...the Arado. However, a relatively few E-series fighters had been completed, and production switched in 1936 to the F-series, powered by the BMW VI 7.3 engine.

Opposite: Seated within the cramped quarters of a Bf 109 E-3 cockpit, this Luftwaffe pilot is wearing a pneumatic lifevest in case he should be forced down over water.

Above: TheArado Ar 68 V5, D-ITEP, was the production prototype for the Ar 68 E-series of fighters.



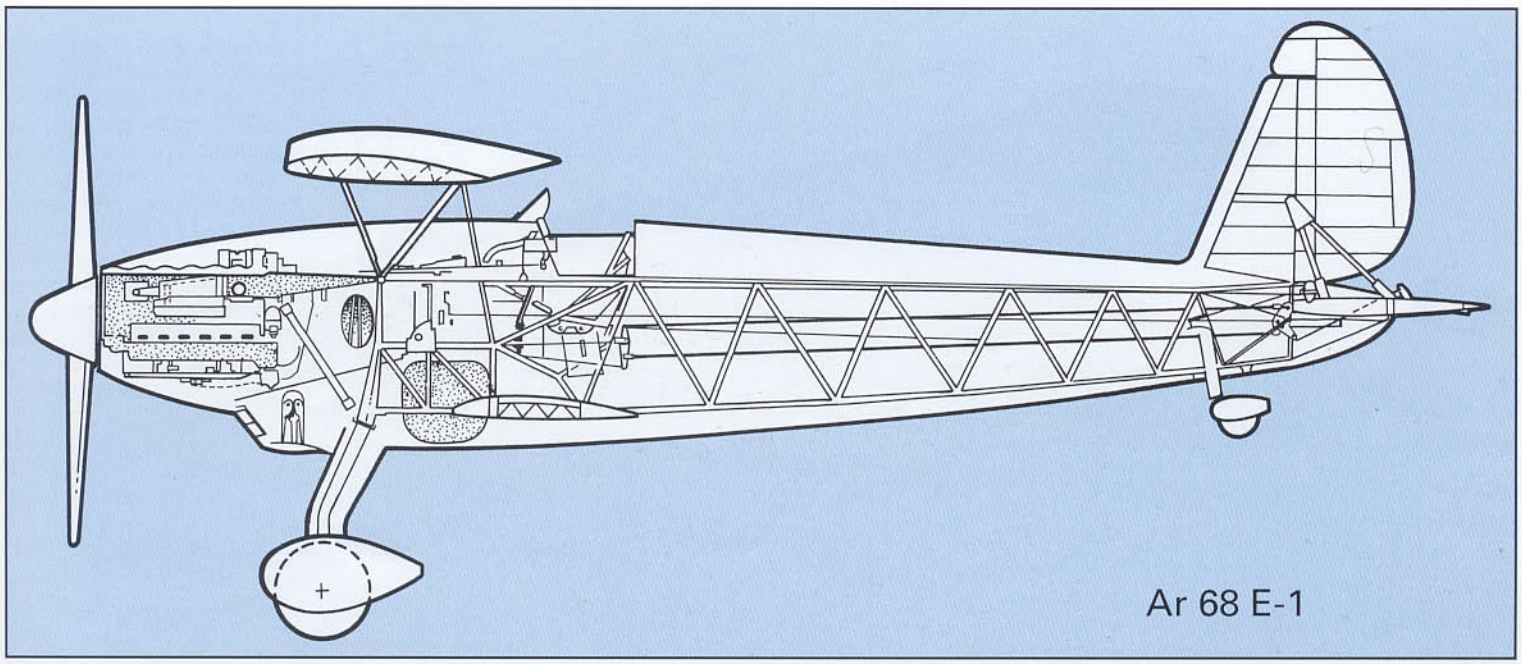
Arado Ar 68 E-1

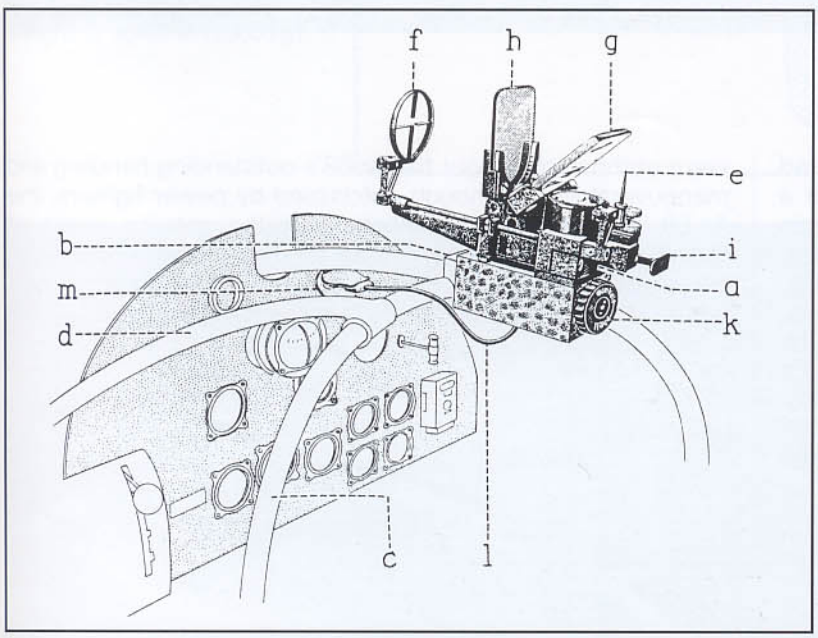
1 Landeklappenbetätigung
2 Höhenhilfsruderverstellung
3 Gemischhebel
4 Gashebel
5 Starterknopf
6 Kühlerklappenverstellhebel
7 Schmierstoffkühler-verstellhebel
8 Gerätebrettlampen
9 Netzausschalter
10 Zündschalter

11 Brandhahnhebel
12 Fußhebel für Seitensteuerung
13 Borduhr
14 Empfindlichkeitsregler
15 Höhenmesser
16 Fahrtmesser
17 Schauzeichen für Staurohrheizung
18 Kompaß
19 Wendezeiger
20 Schwingungsanzeiger
21 Einspritzpumpe
22 Schaltkasten für FT-Anlage
23 Signallampe
24 Ladedruckmesser
25 Drehzahlmesser
26 Steuerknüppel
27 Schmierstofftemperaturmesser
28 Schmierstoffdruckmesser
29 Kraftstoffvorratsmesser
30 Boschtaste für FT
31 MG-Abzug
32 Kühlstofftemperaturmesser
33 Kraftstoffdifferenzdruckmesser
34 Luftpumpe zum Kraftstoff-vorratsmesser
35 Druckknopf für MG-Kamera-Auslösung
36 Ask.-V.-Schalter
37 Handpumpenzug
38 Sicherungskasten
39 Strom- und Spannungsmesser
40 Einpoliger Sicherungskasten
41 Schaltkasten
42 Ferntrennschalter
43 Verdunkler
44 Nebenwiderstand
45 Handfeuerlöscher
46 Leuchtpistole
47 Ruderkantenbetätigung
48 Höhenatmer
49 Leuchtpatronenhalter

Juli 1940

Arado Ar 68 E
Geräte im Flugzeug-Führerraum
Anforderungszeichen: Fl Gb 8-006



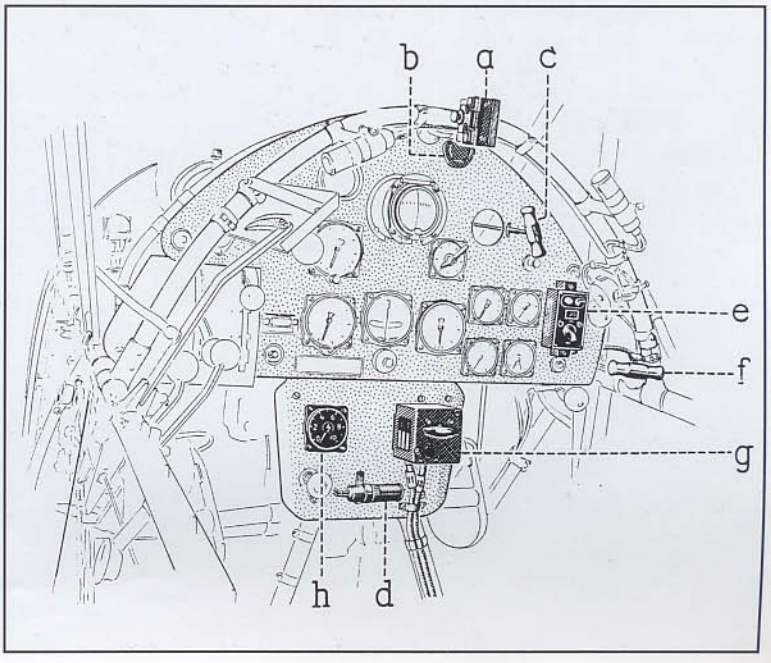


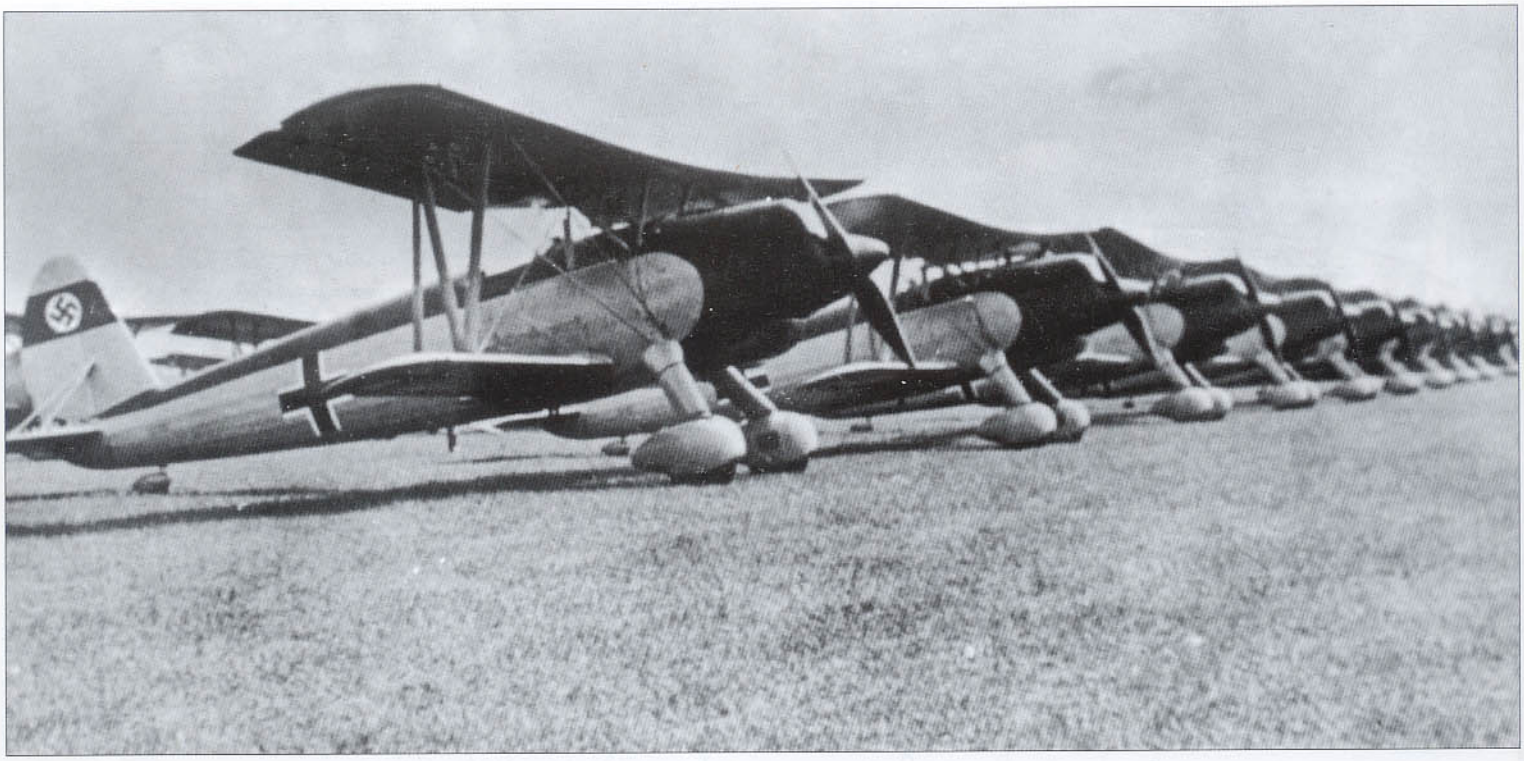
Opposite top: An Ar 68 E-1 parked at Vienna-Voslau during the winter of 1940.

Left: Diagram of Revi 3b installation. (a) Revi 3b gunsight, (b) gunsight attachment, (c) tubular mounting frame, (d) bracing frame, (e) rear bead sight, (f) front ring and cross sight, (g) optical sighting panel, (h)sun filter, (i) grip for connecting rod, (k) rheostat knob, (l) electrical cable, (m) electrical socket.

Below: Instrument panel layout. (a) slotted tail block for Revi 3b, (b) electrical socket for gun sight power, (c) cocking handle for MG 17s, (d) signal lamp for gun camera, (e) ASK-V switch box for optional bomb load, (f) red-painted emergency jettison handle and Bowden cable connection to bomb carrier, (g) switch box for radio telephone equipment, (h) frequency strength indicator.

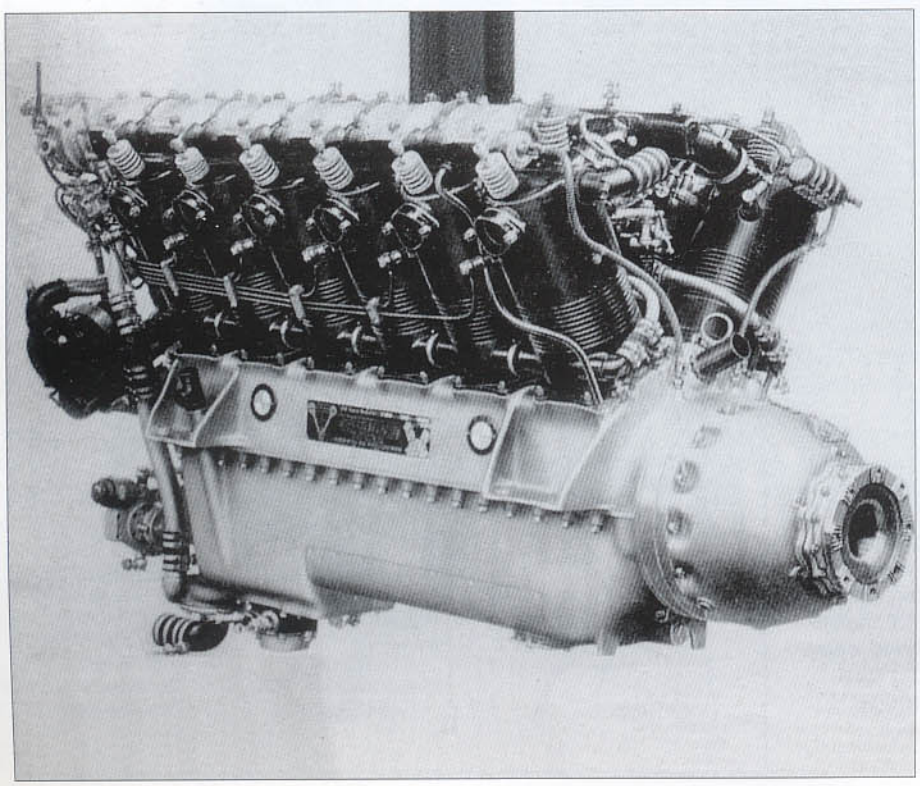
Left: General arrangement drawing of the Ar 68E cockpit. (1) landing flaps operating crank, (2) elevator trim, (3) mixture lever, (4) throttle, (5) starter knob, (6) radiator flap lever, (7) oil radiator flap lever, (8) instrument panel light, (9) master electrical cut-out button, (10) magneto switches, (11) fuel cut-off lever, (12) rudder pedals, (13) chronometer, (14) frequency selector, (15) fine and course altimeter, (16) air speed indicator, (17) visual indicator for pitot head heating, (18) magnetic compass, (19) turn and bank indicator, (20) frequency strength indicator, (21) fuel priming pump, (22) switch box for radio telephone equipment, (23) signal lamp for gun camera, (24) manifold pressure gauge, (25) tachometer, (26) control column, (27) oil temperature gauge, (28) oil pressure gauge, (29) fuel contents gauge, (30) radio telephone button, (31) firing lever for two MG 17 machine guns, (32) coolant temperature gauge, (33) fuel pressure gauge, (34) air pump for fuel pressure supply gauge, (35) press button release for mix of machine guns and gun camera, (36) ASK-V switch, (37) hand pump, (38) arming switch panel, (39) Amp and volt meter, (40) safety switch box, (41) switch box, (42) master switch, (43) instrument panel lighting rheostat, (44) volume control, (45) hand-operated fire extinguisher, (46) Walther flare pistol, (47) rudder trim control, (48) oxygen bottle control gauge, (49) Flare cartridge holder.





Arado Ar 68 F-1

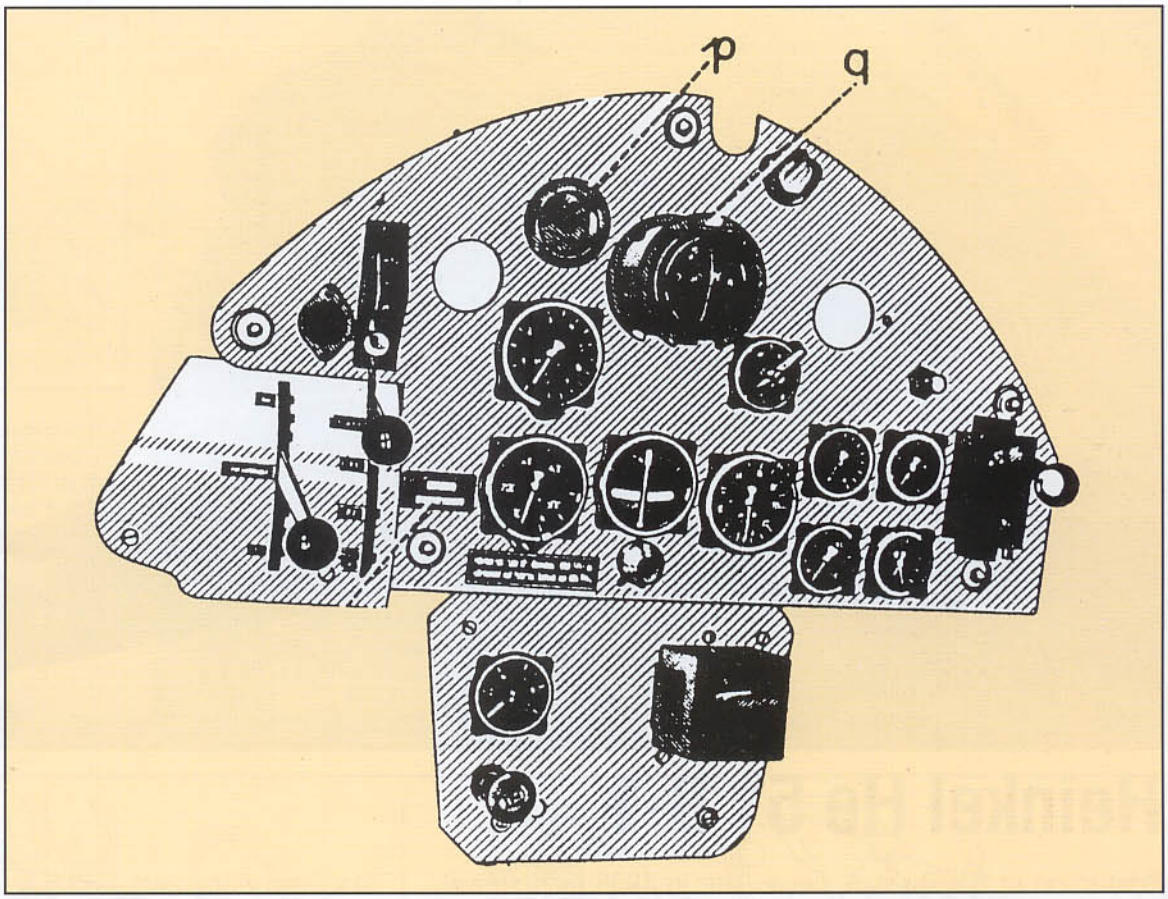
The success of the Ar 68 E-1 was in large measure attributed to its engine, the new Jumo 210. However, because of a shift in priorities, the limited pool of these power plants was unexpectedly allocated to other aircraft. As a consequence, during the summer of 1936 Arado produced the Ar 68 F-1, powered by the more plentiful BMW VI 7.3Z rated at 750 hp, which gave the F-series a top speed of 205 mph (330 km/h). Although marginally faster than the E-1, this series was a disappointment and relatively few were built before production reverted back to the E-1 during the autumn of 1936. The type entered service with I./JG 134 "Horst Wessel" based at Werl, and I./JG 131, which operated from Jessau. Pilots were enthusiastic about the Ar 68's outstanding handling and maneuverability. Although outclassed by newer fighters, the Ar 68 F-1 saw limited combat during the opening weeks of the war in Europe. After a brief stint as a night fighter with 10. *(Nachtjagd)*/JG 53 late in 1939, the remaining Ar 68s were reassigned to various flight schools in Germany.



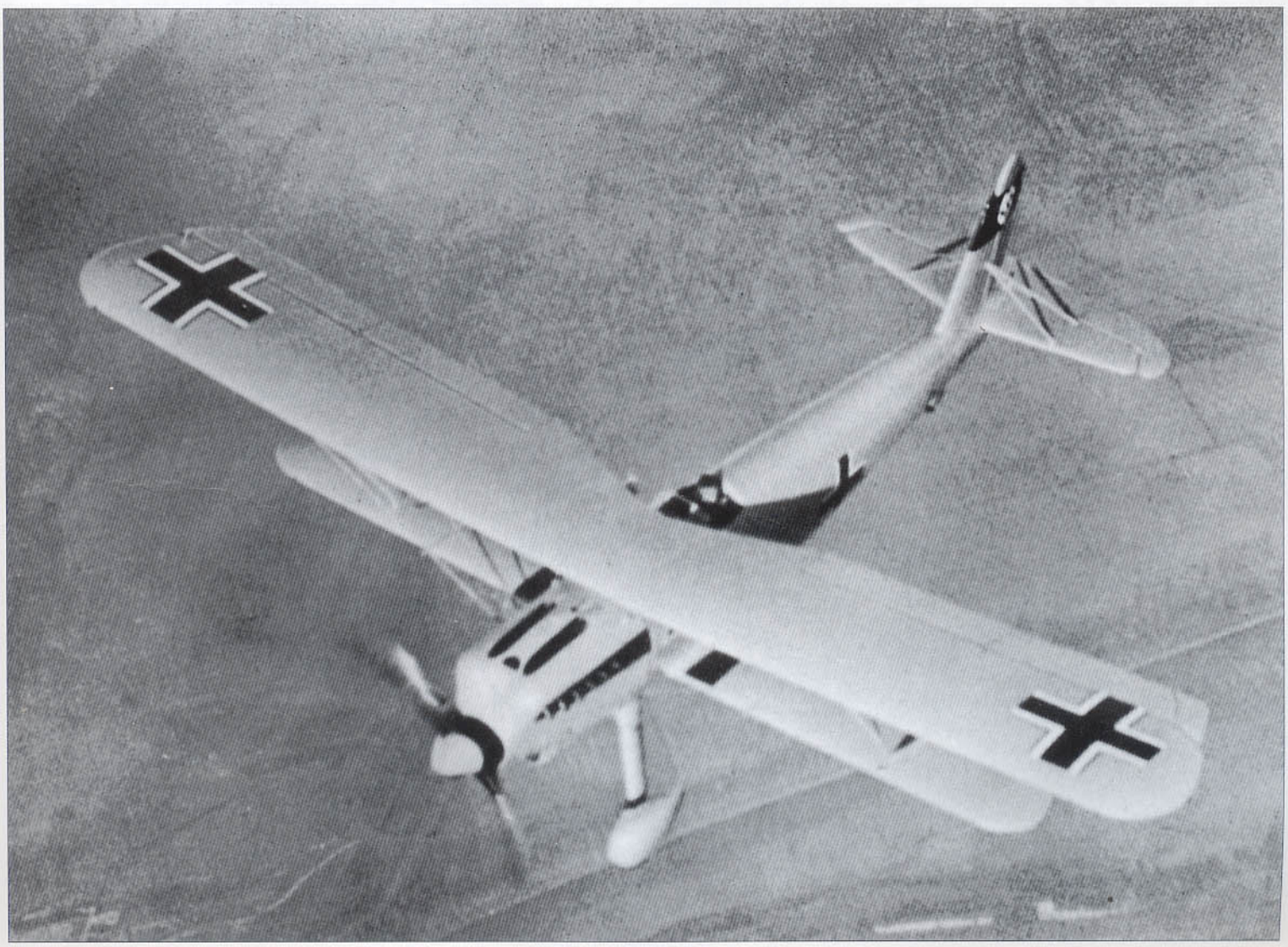
Top: A line up of newly produced Ar 68 F-1s.

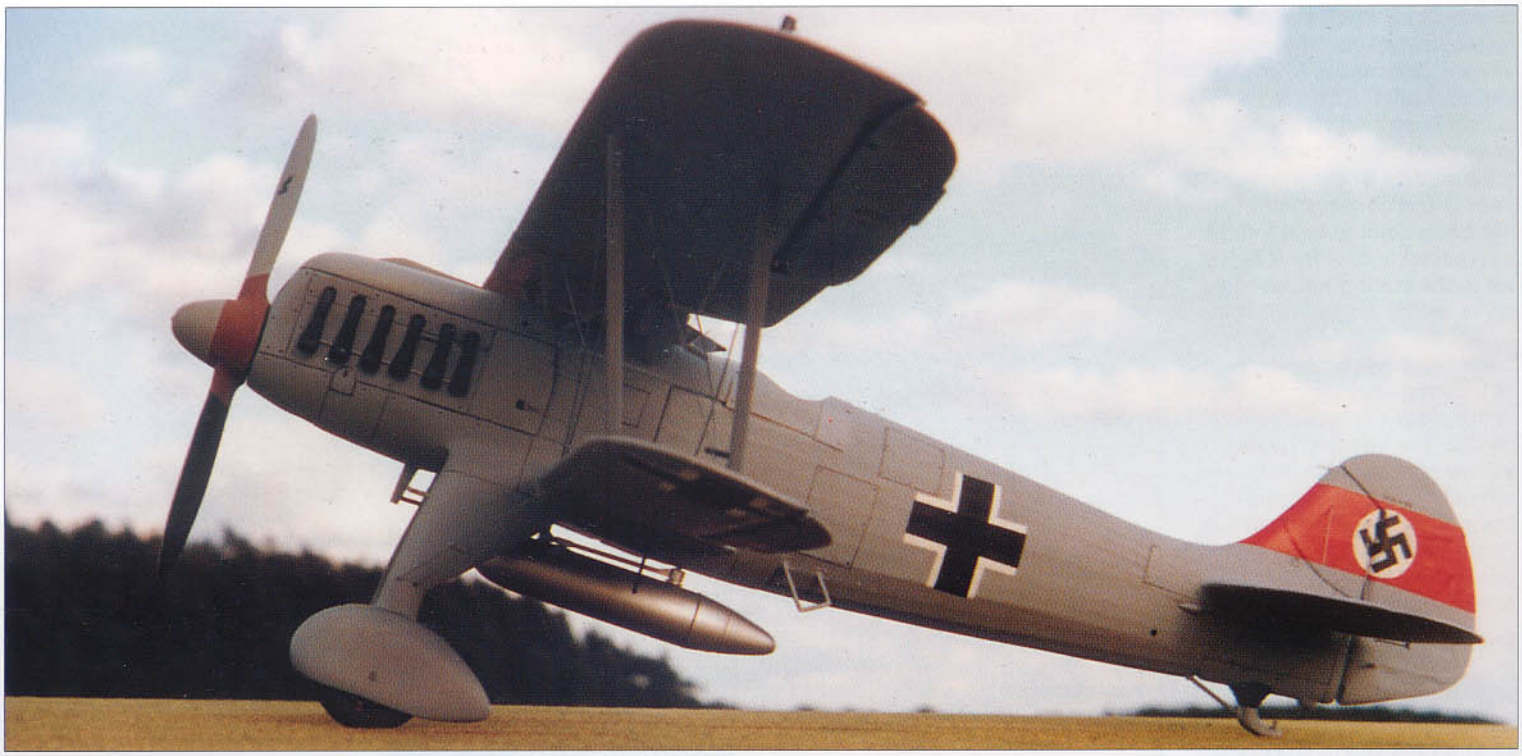
Left: Powerplant for the Ar 68 F-series was the 12 cylinder, liquid-cooled, BMW VI. Produced between 1926 and 1934, this v-type , 47 litre engine developed 750 hp for take off.

Right: Drawing of the Ar 68 F instrument panel showing several differences from the earlier model. The inertia starter knob and oil cooler lever have been deleted from the port side of the main panel. The chronometer (p) has been deleted as a fixture, a recessed holder for it being set in the position previously occupied by the radio frequency selector. The latter has been repositioned to the right of the magnetic compass, set in the place previously occupied by the fine and coarse altimeter. Engine instrumentation has been grouped lower on the right side of the panel, a dual fuel and oil pressure gauge being fitted at the bottom right.



Below: With a metal tubular fuselage covered by fabric and with wings made from wood, the Ar 68 F-1 had a flying weight of 4,409 lb (2000 kg).



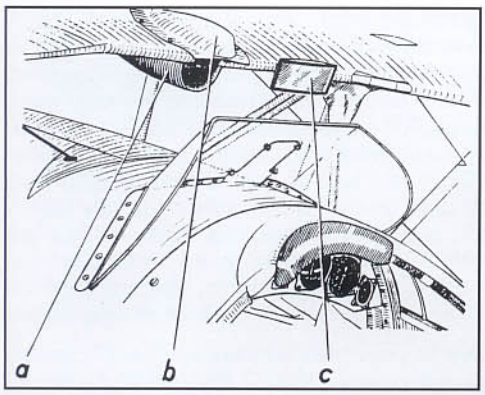


Heinkel He 51 B-1

Production of the B-series began late in 1935, and steadily gained momentum during the first half of 1936. This variant differed from the A-series in having provision for a 170 litre (45 gal.) drop-tank beneath the fuselage plus additional bracing of the undercarriage by thin wire. It was powered by the same BMW VI 7.3Z engine as fitted to the Ar 68 F-1 (see p. 38) which gave the Heinkel fighter a top speed of 205 mph (329 km/h). The first unit to receive the He 51 B-1 was the I./JG 132 based at Döberitz. Pilots found the Heinkel fighter to be somewhat temperamental, but once mastered, it proved to be a stable gun platform. In addition to its service within Germany, numerous examples of the He 51 B-1 were sent to Spain in response to, and in support of, General Franco's Nationalist forces. However, in spite of early successes, the Heinkel fighter did not match the performance or firepower of the Republican I-15s produced in the Soviet Union by Polikarpov, and it was not long before the Heinkel 51s were withdrawn as purely fighters and fitted with underwing bomb racks for the close-support role. By the time war in Europe erupted in September 1939, the He 51 had been largely relegated to training duties with various flight schools.

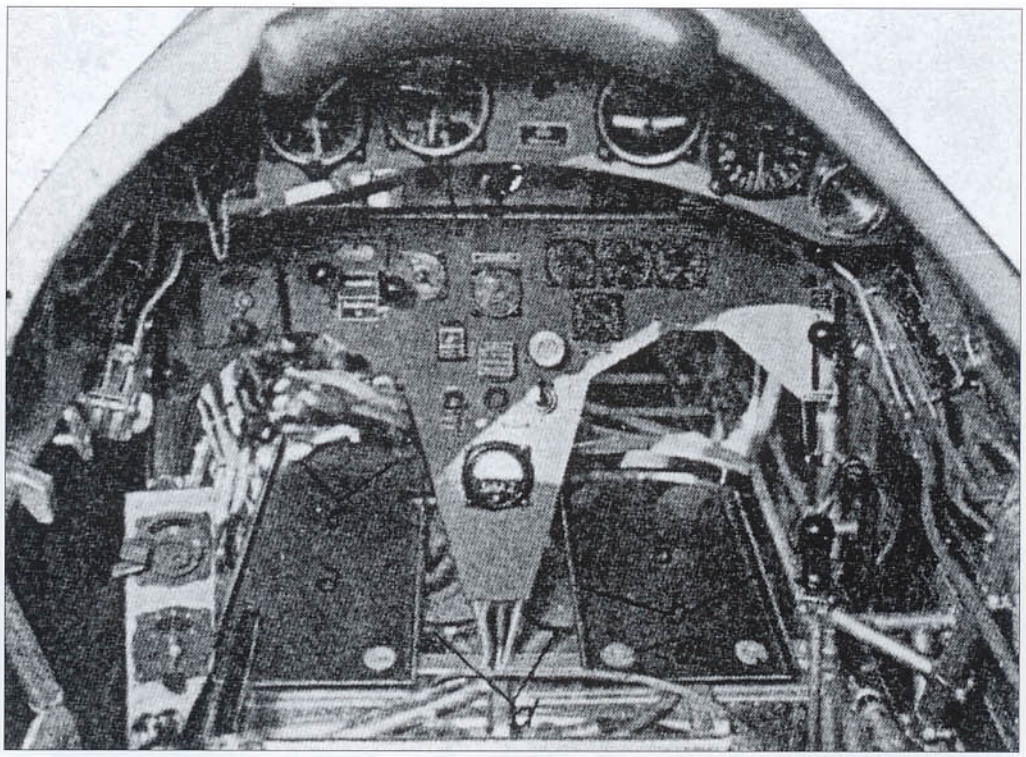
Top: Master model builder Günter Sengfelder, created this splendid large scale model of a He 51 B-1 complete with auxiliary under fuselage fuel tank.

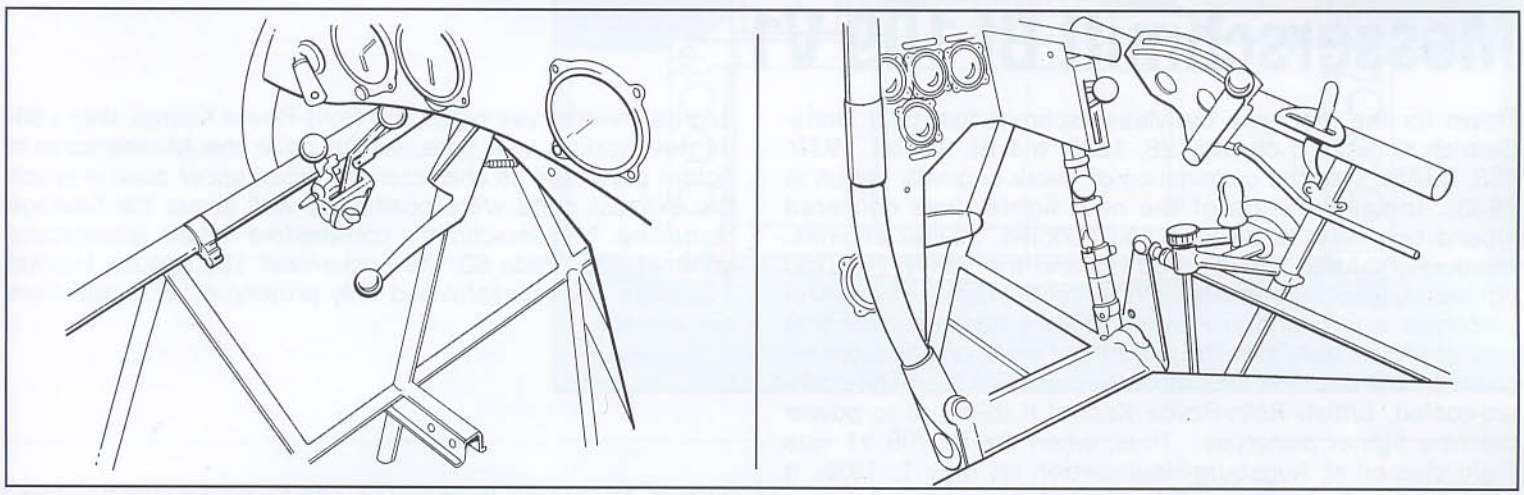
Left: A line up of He 51 B-1s of *Jagdgeschwader* 132 "Richthofen" in January 1936. German national colors across the vertical tailplane have been obscured by postwar retouching.



Above: Wing center section housed (a) oil filled compass set into streamlined fairing (b) with rear view mirror (c) in the center. Note cut-out in windscreen for gunsight.

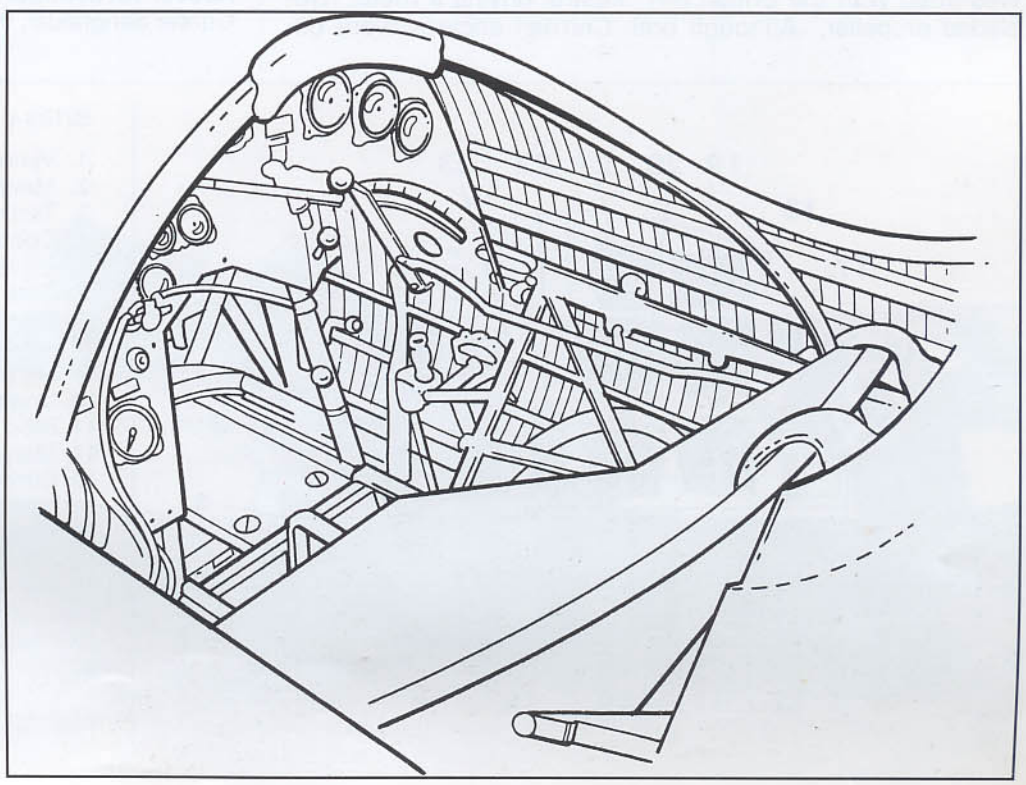
Right: General view of the cockpit showing the blind flying instruments on the top panel with engine instruments located on the lower panel.





Above left and right: Throttle and (a) tail wheel lock lever. Starboard side view showing fuel pump priming handle, tailplane trim handle and inertia starter handle (b) stowed directly below the flap selector lever.

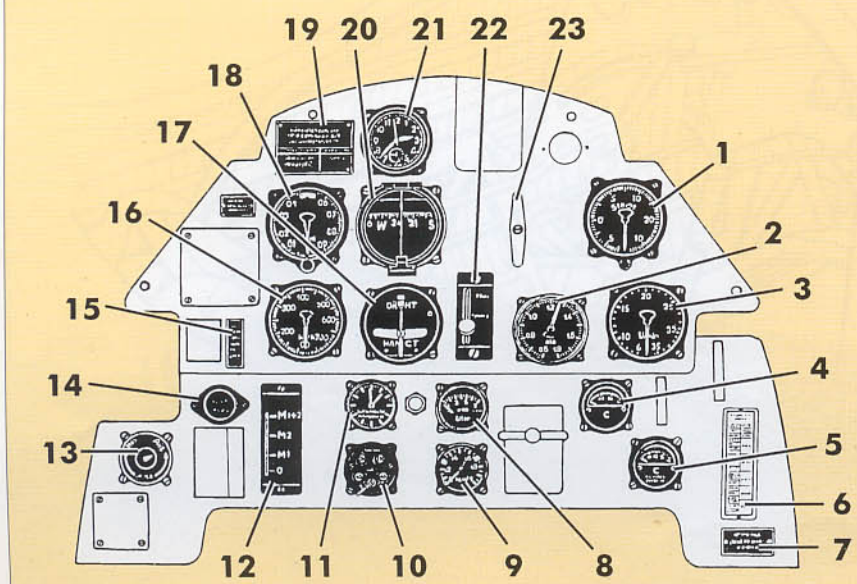
Right: General arrangement view of starboard side of cockpit. Note the suspended floor panels below the rudder pedals. The pilot's seat is pressed aluminum suspended on a tubular frame.



Messerschmitt Bf 109 V1

Flown for the first time by Messerschmitt test pilot Hans-Dietrich Knoetzsch on May 28, 1935, the Bf 109 V1, W.Nr. 758, D-IABI, was the culmination of work originally begun in 1933. Initially, design of the new fighter was centered around two new 12-cylinder, liquid-cooled, 20-liter engines, the Junkers Jumo 210 A (680 hp) and the BMW 116 (750 hp) then under development. When construction of the first prototype was begun in August 1934, it became clear that neither engine would be ready for flight trials, and as a consequence, the decision was made to procure a 12-cylinder, liquid-cooled, British Rolls-Royce Kestrel II (695 hp) to power the new fighter prototype. Thus, when the Bf 109 V1 was flight cleared at Augsburg-Haunstetten on May 1, 1935, it was fitted with the British R-R Kestrel driving a metal two-bladed propeller. Although both German engines were 60-degree inverted vee types, the Rolls-Royce Kestrel was a 60-degree upright vee type, which gave the Messerschmitt fighter prototype its characteristic broad upper cowl in which the exhaust ports were positioned well above the fuselage centerline. Messerschmitt's competitors for the government contract, the Arado 80, the Focke-Wulf 159 and the Heinkel 112 were unsuccessful and only prototypes of these were completed.

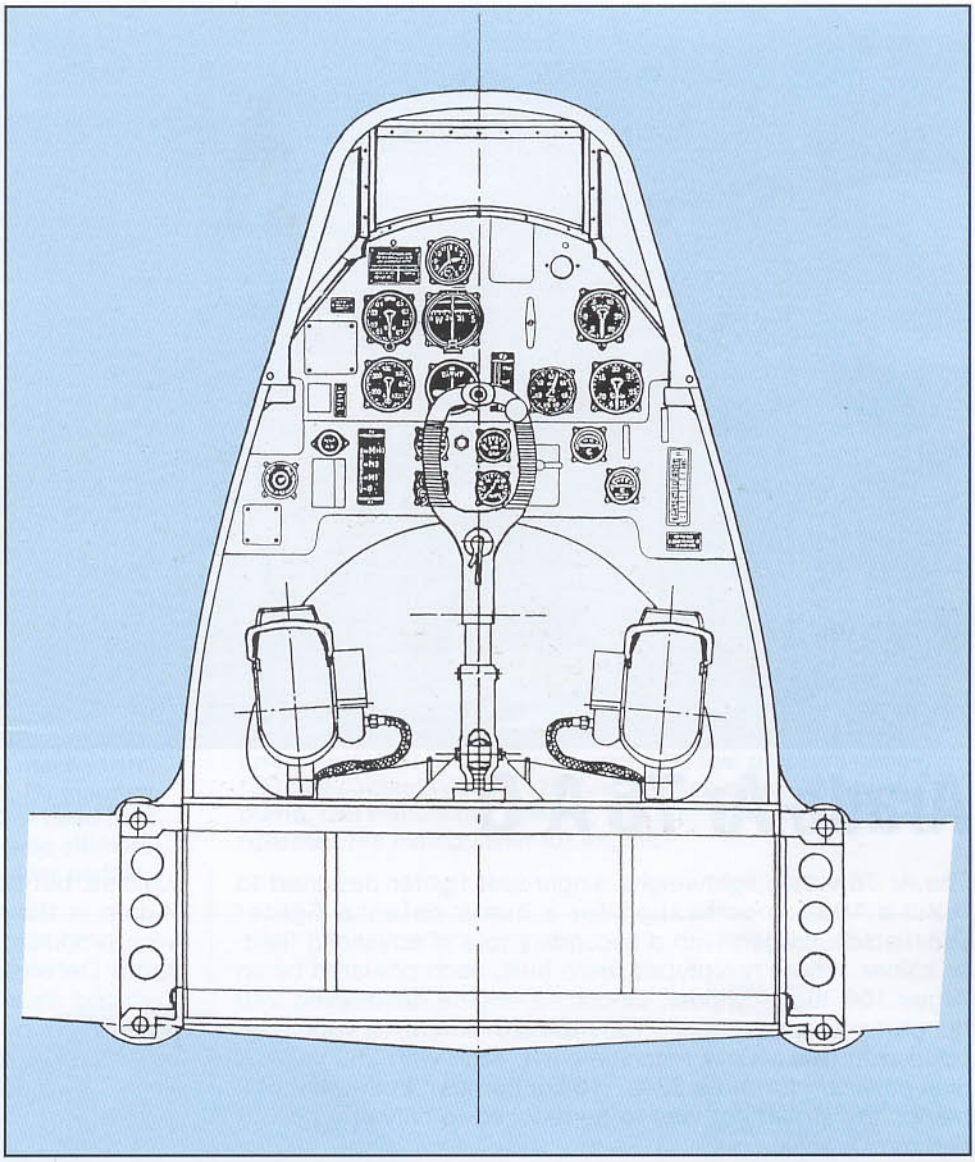
Above: An accurate large-scale model by master model builder Günter Sengfelder, of the first "Me 109", the Bf 109 V1.



Bf109 V1 Instrument Panels

1. Variometer
2. Manifold pressure gauge
3. Tachometer
4. Coolant temperature gauge
5. Oil temperature gauge
6. Data placard
7. Manufacturers placard
8. Fuel contents gauge
9. Oil pressure gauge
10. Undercarriage indicator
11. Prop indicator
12. Mangeto switches
13. Dimmer control switch
14. Master cut-out buttom
15. Data placard
16. Air speed indicator
17. Turn and bank indicator
18. Altimeter
19. Placard for flap settings
20. Magnetic compass
21. Clock
22. Prop control switch
23. Undercarriage control lever

Right: This sectional view of the cockpit of the Bf 109 V1, as viewed from just in front of the control column, shows the complete instrument panel in position within the airframe. Note that all early Messerschmitt 109 fighters actually had two panels. The lower section was independent of the top and was positioned slightly closer to the firewall than the main panel. Note the distinctive shape of the control column head, which was quite different from the first production series of the fighter (see p. 48-49).

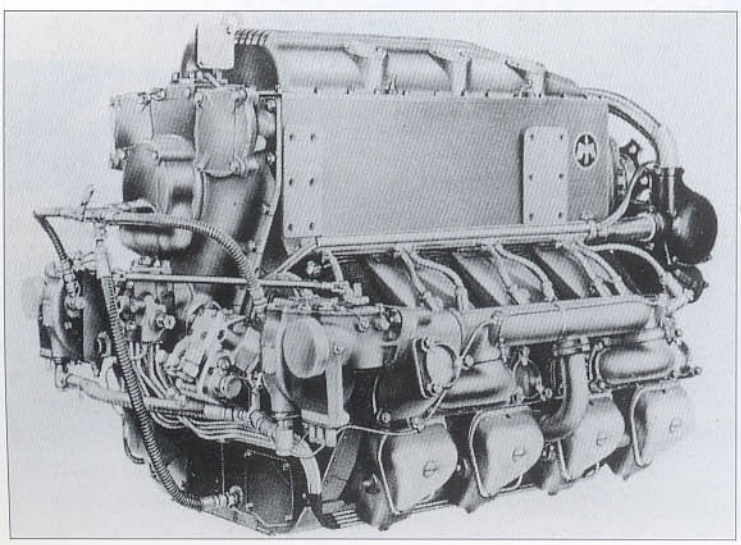


Below: This three-quarter rear view of the Bf 109 V1, W.Nr. 758, D-IABI, shows the prototype undergoing tests at Rechlin. Note the distinctive blue paint trim to the lower portion of the rear fuselage. Such paint schemes were frequently later applied to specific aircraft for company promotional purposes and were never intended for production aircraft.

Arado Ar 76 A-0

The Ar 76 was a lightweight, single-seat fighter designed to fulfill a 1933 specification for a home defense fighter *(Heimatschutzjäger)* with a secondary role of advanced fighter trainer. Three prototypes were built, each powered by an Argus 10C eight-cylinder, air-cooled engine developing 240 hp, giving a top speed of 166 mph (267 km/h). It was to be fitted with two MG 17 machine guns, each with 250 rounds, plus provision for three 22-lb. (10-kg) bombs. In the role of a trainer, the armament was to be reduced to only one MG 17 (7.9 mm) machine gun.

The *Heinatschutzjäger* specification was also issued to three additional firms: Focke-Wulf, Heinkel and Henschel. The Focke-Wulf contender, the Fw 56 was judged to be the better airplane and was awarded the primary contract, with the Arado 76 coming in second place. However, it was decided to build a small batch of ten pre-production aircraft, under the designation Ar 76 A-0, for service evaluation. These aircraft were completed in the spring of 1936 and immediately assigned to flight-training schools. Heinkel's contender, the He 74, was a lightweight biplane with outstanding aerobatic qualities, but because the biplane was rapidly becoming out-of-date in the minds of the officials, only a small number were produced. The fourth firm to submit a design for the Home Defense Fighter specification was Henschel which produced its small Hs 121. This design featured a braced, high-wing or gull-wing configuration attached to a metal fuselage. Unfortunately, the Hs 121's handling characteristics were significantly substandard and only one prototype was completed.

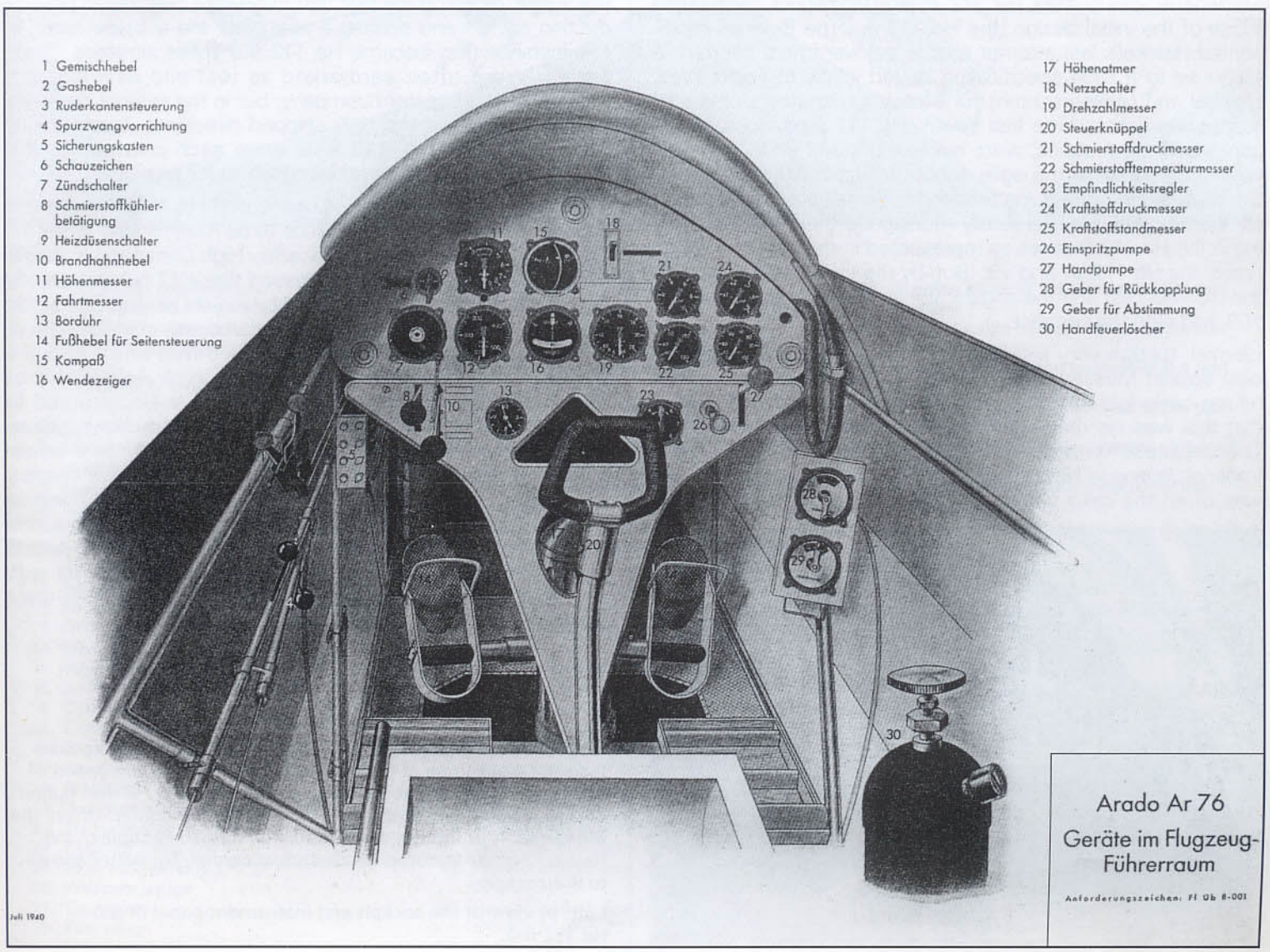


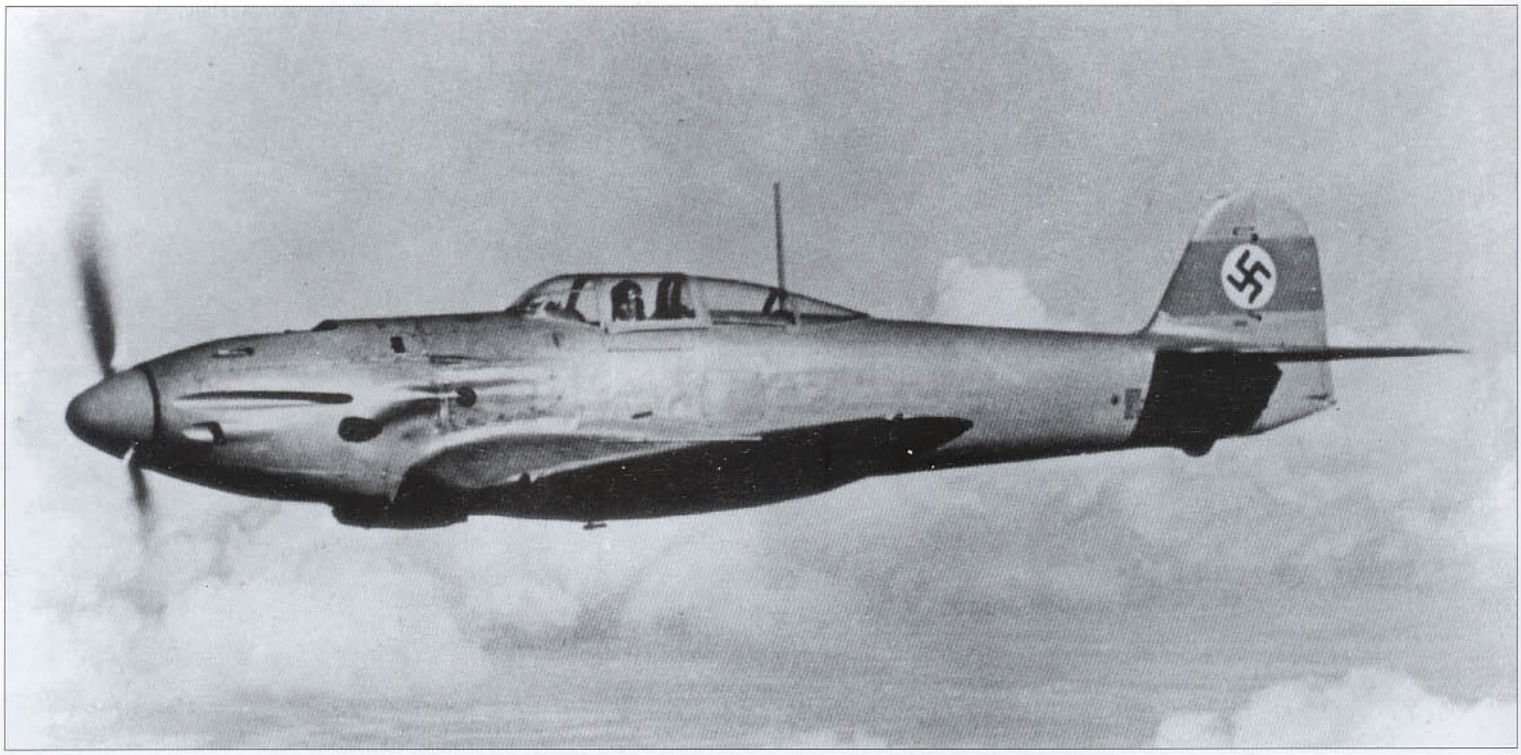
Above: This three-quarter rear view of the Ar 76 V2, D-IRAS, shows to advantage the simple, yet pleasing lines of the second prototype.

Left: Powerplant for the Ar 76 A-0 was the Argus As 10 C, an inverted air-cooled eight-cylinder engine developing 240 hp.

Above: With a wing span of 31.2 feet (9.50 m) and a length of 23.6 feet (7.20 m), the Ar 76 A-0 was fitted with an open cockpit.

Below: A view of Ar 76 A-0 cockpit showing (1) mixture lever, (2) throttle, (3) rudder trim, (4) tail wheel aligning mechanism, (5) fuse box, (6) pitot head heater visual indicator, (7) magneto switches, (8) oil cooler flap operating lever, (9) pitot head heating switch, (10) fuel cut-off lever, (11) fine and coarse altimeter, (12) air speed indicator, (13) chronometer, (14) rudder pedals, (15) magnetic compass, (16) turn and bank indicator, (17) oxygen bottle, (18) master electrical cut-off switch, (19) tachometer, (20) control column, (21) oil pressure gauge, (22) oil temperature gauge, (23) frequency selector, (24) fuel pressure guage, (25) fuel contents gauge, (26) fuel priming pump, (27) hand pump, (28) transmitter selector, (29) tuning selector, (30) hand operated fire extinguisher for engine.



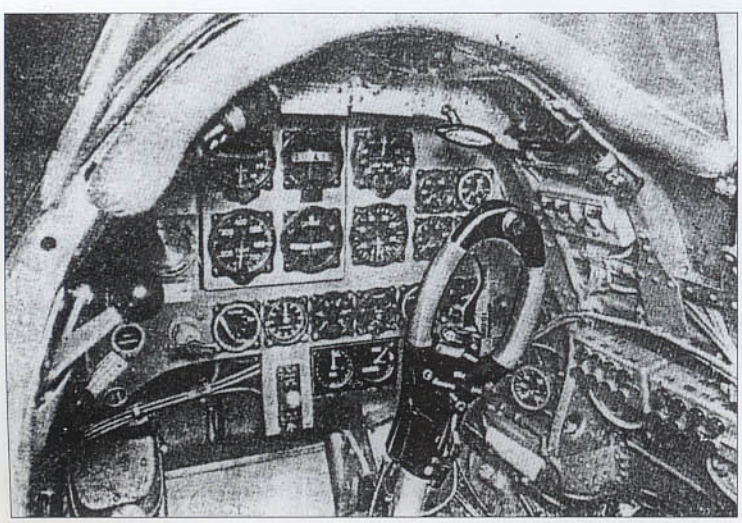


Heinkel He 112 B-0

The sleek and aesthetically pleasing lines of the fighter from Marienehe, designated He 112 B, are in distinct contrast to those of the initial design, the He 112 A. The B-series represented Heinkel's last attempt to gain a government contract in response to a 1934 specification issued jointly to Focke-Wulf, Heinkel and Messerschmitt for a new generation single-seat monoplane fighter. The first seven He 112 prototypes, which comprised the A-series, were over-weight and under-powered when compared to the agile contender from Messerschmitt, the Bf 109. To correct matters and to better position his entry for the contract, Heinkel totally redesigned their fighter, resulting in the He 112 B-series as represented in the next two prototypes, the He 112 V7 and V9. But, by the time these appeared, the die was cast and the angular fighter from Augsburg, the Bf 109, had won the contract.

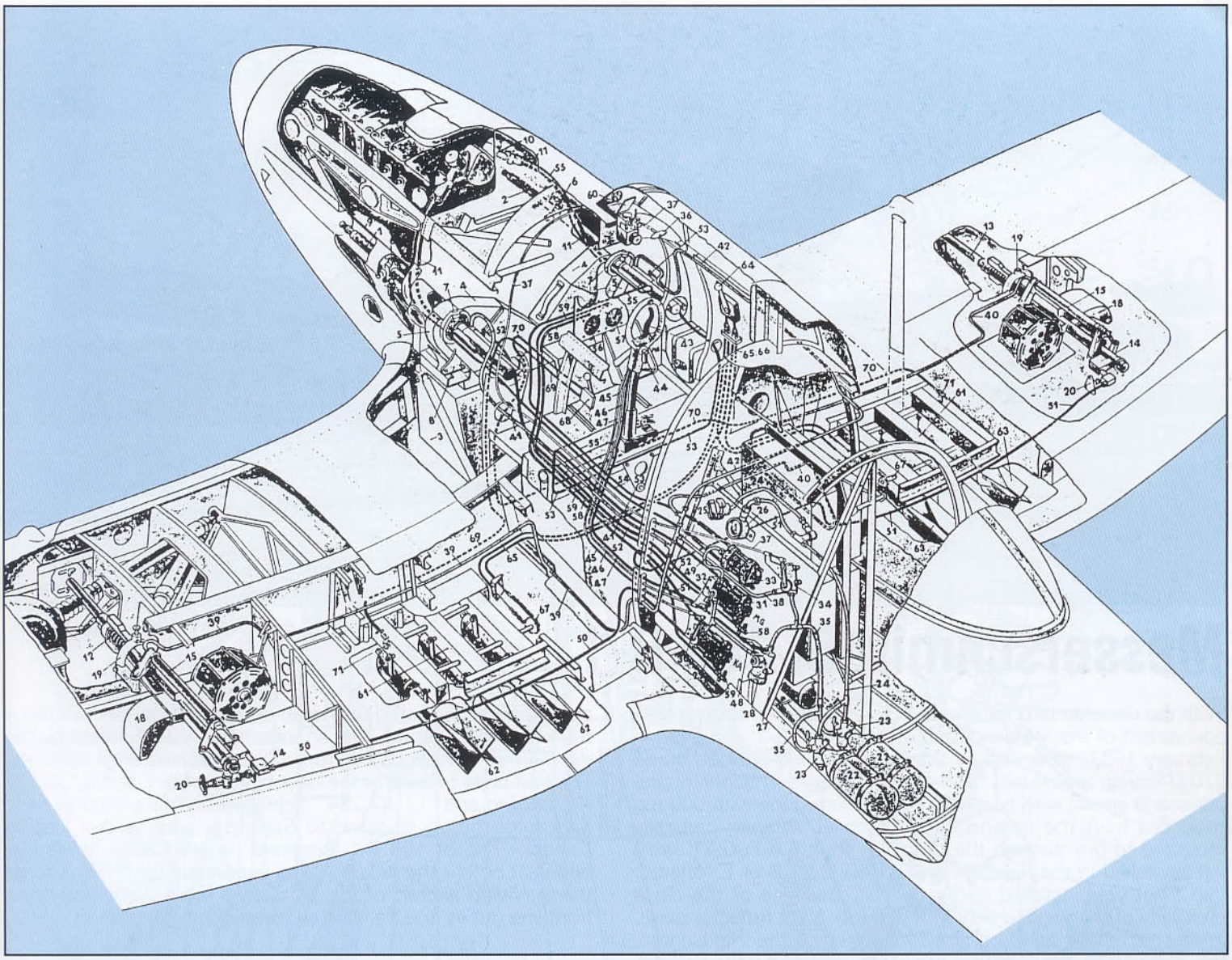
Heinkel, though very disappointed at having come in second-best against Messerschmitt, turned to the export market after having been told by Ernst Udet, Chief of the Technical Office, that this was his only hope to see the He 112 in production. The Japanese were first approached. Soon thereafter the Imperial Japanese Navy placed an order for thirty He 112s. As was often the case within the German aviation industry, the first 10 or 12 aircraft of a new series were known as "0-series" machines, denoting the fact that they were designated pre-production aircraft and bearing a zero after the subtype letter; in this instance they became He 112 B-0 series airplanes. Such aircraft were often earmarked as test and development machines for the parent company, but in the case of these He 112 B-0s, they were simply shipped directly to Japan during May, 1938. The He 112 B-0s were each powered by the Junkers Jumo 210 Ea developing 680 hp for take-off.

The second consignment of one dozen He 112 B-0s for the Japanese was about to take place three months later when the OKL (*Oberkommando der Luftwaffe* - High Command of the Air Force) blocked export and impressed these 12 fighters directly into active service with III./JG 132 based at Damm. This action was intended to bolster German preparedness in anticipation of an Allied response to Germany's planned entry into the Sudetenland. However, with the Munich Agreement of September 30, 1938, the He 112 B-0s were returned to Heinkel for immediate export. By this time, the Japanese had lost interest in the fighter for several reasons and, as a consequence, no further examples were sold to Japan. It is interesting to note, that while the dozen Heinkels were being flown by German pilots of JG 132, they were highly enthusiastic admirers of the He 112 and were hoping the *Luftwaffe* would add this new fighter to its inventory. This was not to be, for with the cancellation of the Japanese contract, the planes were offered to Franco for use in Spain.



Above: An in-flight view of the He 112 B-0 showing to advantage the sleek lines of the Heinkel fighter. With a top speed of 317 mph (510 km/h) at 15,420 feet (4,700 m), the Heinkel fighter was marginally faster than the favored Bf 109 fighter. Unlike the Messerschmitt fighter, which had side hinged canopies, the Heinkel fighter featured an aft-sliding canopy for better access to the cockpit

Left: A view of the cockpit and instrument panel of the He 112 B-0.



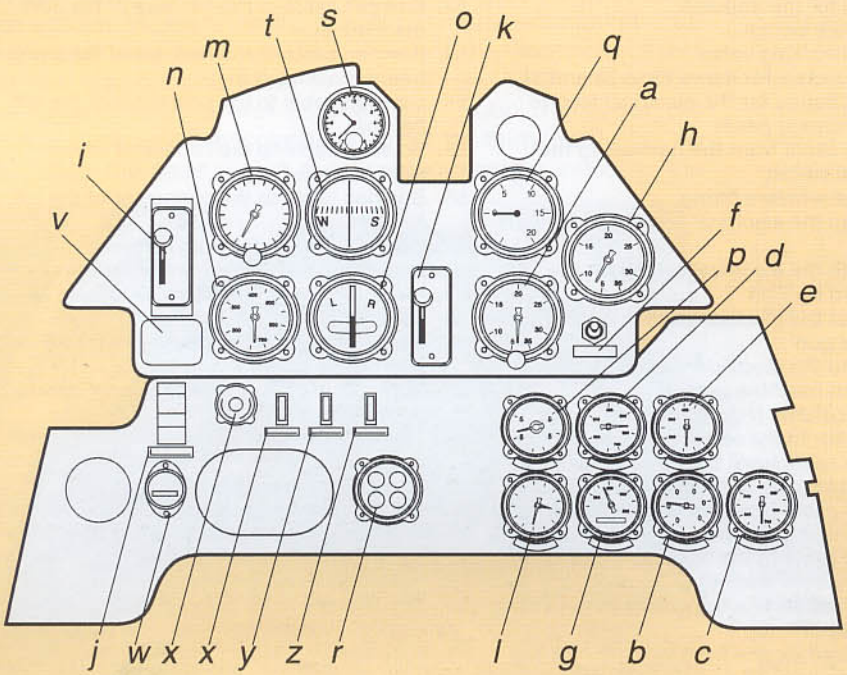
He 112 B-0

1. Port MG 17 machine gun
2. Starboard MG 17 machine gun
3. Ammunition box, left and right, consisting of full and empty containers for shell casings
4. Ammunition feed housing left and right
5. Spent ammunition discharge
6. Front casting and sighting mechanism
7. Rear support
8. Lower bracket
9. Shell blast tube
10. Machine gun synchronizing equipment
11. Impulse tramsmitting cables.
12. Örlikon MG FF cannon in left wing
13. Örlikon MG FF cannon in right wing
14. Weapon trigger housing
15. Weapon cocking cylinder
16. 60-round magazine drum
17. Cartridge feed chute
18. Spent shell discharge
19. Forward gun mount
20. Rear support casting
21. Blast tube
22. Two pressurized air containers
23. Two pressure reducer valves
24. External filling line
25. External filler point
26. Pressure gauge
27. Base plate
28. Fire valve
29. Cannon firing housing
30. Forward firing switch
31. Machine gun firing housing
32. Machine gun forward firing switch
33. Housing for the impulse impedance switch
34. Weapon cocking valve
35. Pressurized air for items 23 to 28 and 34
36. Harness flange for the electrical feed to the instrument panel
37. Bowden cable from the harness to the electrical switch
38. Main line with tee fitting
39. Air line to the electrical switch for the port cannon
40. Air line to the electrical switch for the starboard cannon
41. Air line to the electrical switch for the port machine gun
42. Air line to the electrical switch for the starboard machine gun
43. Control column trigger and grip
44. Preselector to the control column trigger
45. Bowden cable from the preselector for the cannon from item 44 to item 30
46. Bowden cable from the preselector for the machine guns from item 44 to item 32
47. Bowden cable to the harness of the weapons from item 43 to item 28
48. Pressurized air line from item 28 to item 29 and 31
49. Pressurized air line from item 31 over the throttle to item 33
50. Bowden cable to the harness of the port cannon
51. Bowden cable to the harness of the starboard cannon
52. Bowgen cable to the harness of the port machine gun
53. Bowden cable to the harness of the starboard machine gun
54. Bowden cable to the connector of the left harness
55. Bowden cable to the connector of the right harness
56. Bowden cable to the connector of the left harness
57. Round counters for both cannon
58. Measuring lead from item 56 to item 31
59. Measuring lead from item 57 to item 29
60. Revi gunsight
61. Assembly with 3 bomb carriers for left and right wings
62. Three 22 lb (10 kg) anti-personnel bombs under left wing
63. Three 22 lb (10 kg) anti-personnel bombs under right wing
64. Bomb release switch in cockpit
65. Left cable line from item 64 to item 67
66. Right cable line from item 64 to item 67
67. Bomb carrier releasing drive
68. Fuse arming switch in cockpit
69. Left Bowden cable from item 68 to 71
70. Right Bowden cable from item 68 to 71
71. Fuse arming switch for the bomb carrier

Messerschmitt Bf 109 B-1

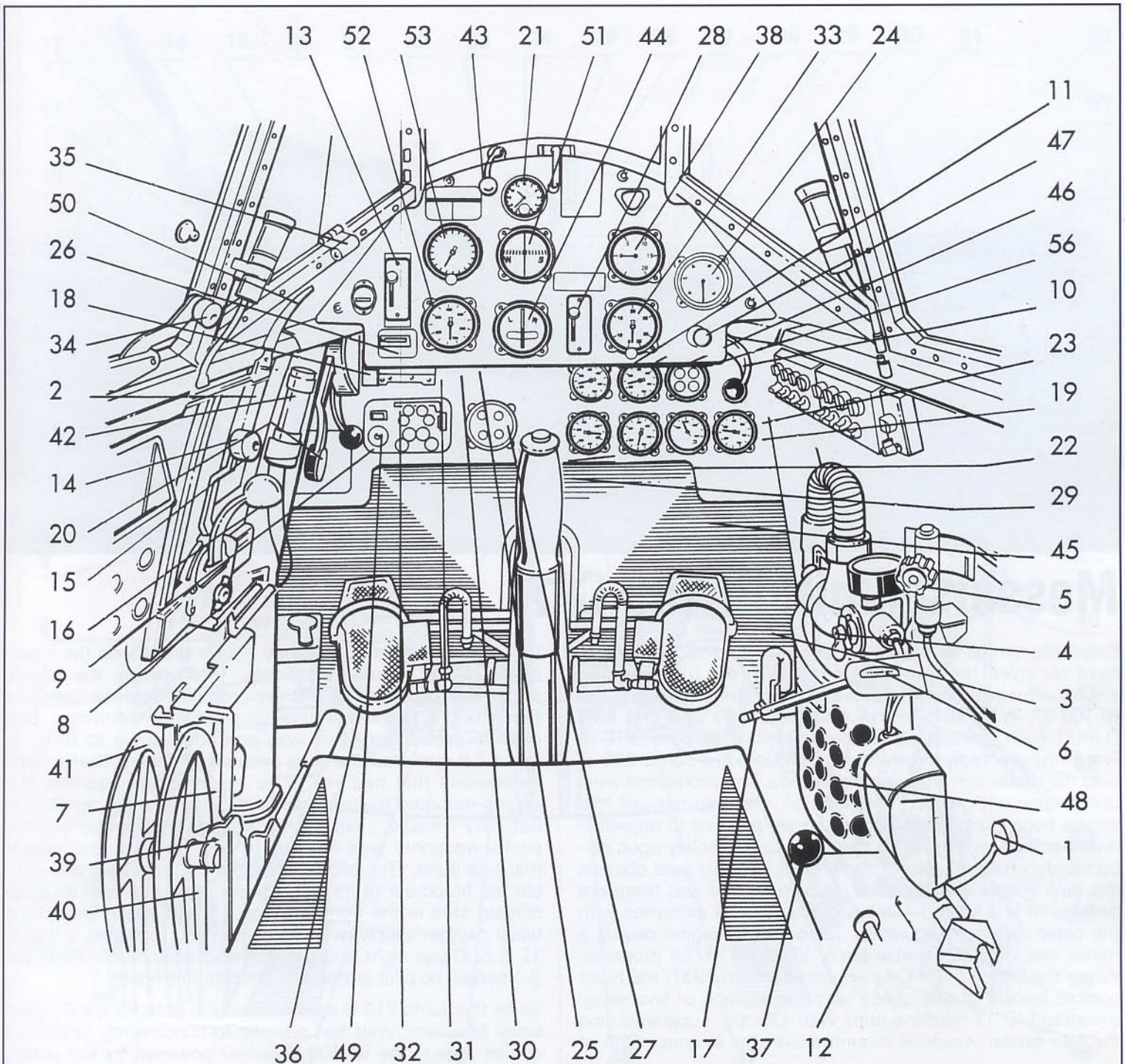
With the decision to drop the Bf 109 A-series, the first production variant of the famous Bf 109, the Bf 109 B-1, appeared in February 1937, powered by the carburetor-fed Junkers Jumo 210 D driving a wooden, fixed-pitch, two-bladed Schwarz propeller and armed with two MG 17 machine guns with 500 rpg mounted over the engine, plus a similar weapon centrally mounted to fire through the propeller shaft. A FuG VII radio was installed in the fuselage and a Revi C 12 B or C reflector gun sight was installed in the cockpit. Because of the close proximity of the windscreen with the gun- sight reflector glass, it was necessary to add a small extension to the windscreen. By June 1937, the Schwarz prop was replaced with a metal, variable-pitch, two-bladed VDM 9-11072A propeller, with no change in the aircraft series designation. Initially all aircraft were fitted with a triple radio antenna wire running from the cockpit mast to the tip of the fin and each stabilizer. Within a relatively short period, this arrangement was modified by the deletion of the two wires running to the horizontal stabilizer. The first units to receive the new fighter were I. and II./ JG 132 *Richthofen* and I./ JG 234 *Schlageter,* with a total of forty examples being shipped to Spain for use by the Legion Condor. The Bf 109 B-1 remained in production for almost one year before the next subtype appeared. By 1939, most of the surviving aircraft of the B-1 series were withdrawn from front-line duties and transferred to various flight schools.

Above: This Bf 109 B-1, DO+MX, was powered by the Jumo 210 D which gave it a top speed of 289 mph (465 km/h) at 13,120 feet (3,999 m).



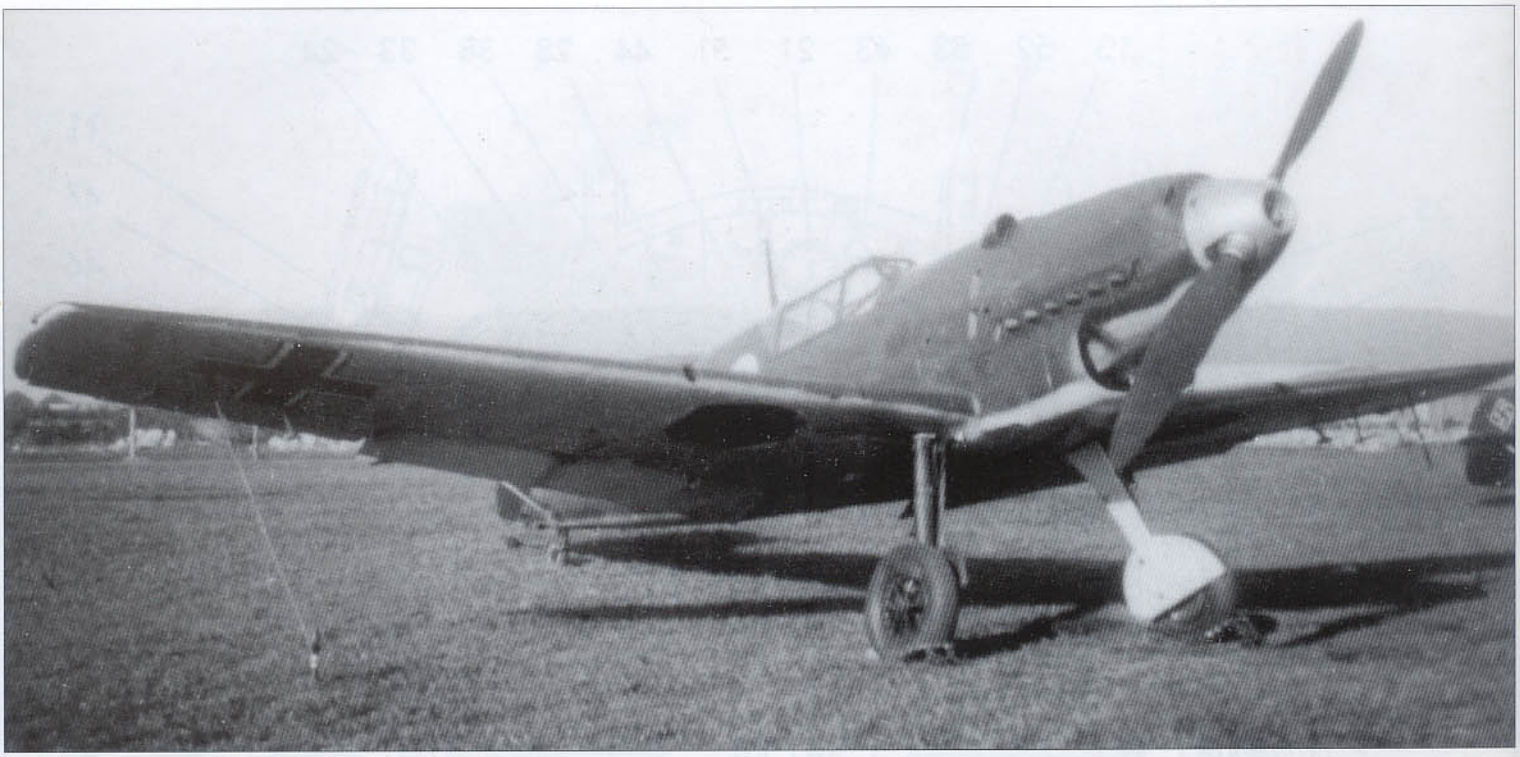
Bf 109 B-1 Instrument Panels

a. Manifold pressure gauge
b. Oil pressure gauge
c. Oil - dual temperature gauge
d. Fuel pressure gauge
e. Fuel contents gauge
f. Pump for fuel pressure gauge
g. Coolant temperature gauge
h. Tachometer
i. Magneto switch
j. Starter pull handle
k. Prop pitch switch
l. Prop pitch indicator
m. Altimeter
n. Air speed indicator
o. Turn and bank indicator
p. Stiffness control
q. Variometer
r. Undercarriage indicator
s. Clock
t. Magnetic compass
u. Dimmer control
v. Warm air nozzle indicator
w. Master electrics cut-out switch
x. Instrument panel light switch
y. Navigation lights switch
z. Heat nozzle switch



Bf 109 B-1 Cockpit

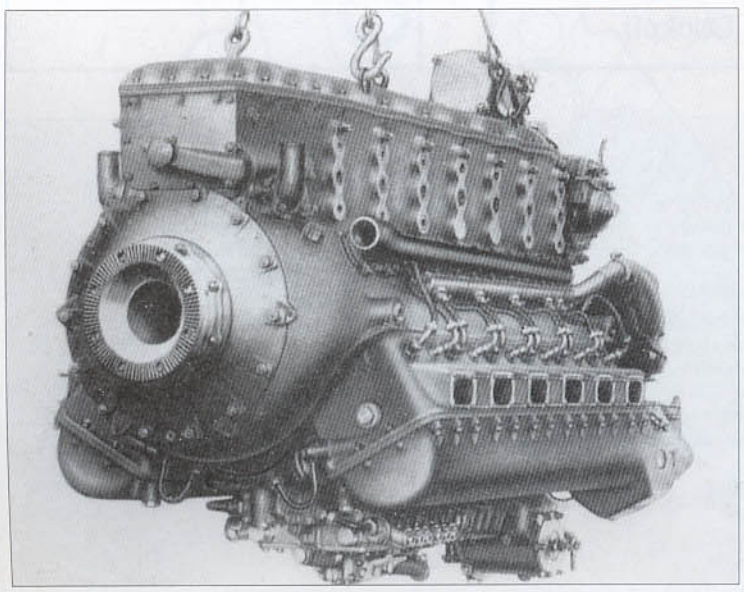
1. Tailwheel lock
2. Data card
3. Priming fuel tank
4. Oxygen shut-off handle
5. Remote oxygen valve
6. Undercarriage switch
7. Locking lever for flap and tailplane pitch
8. Throttle lock friction nut
9. Fuel shut-off lever
10. Fuel hand pump lever
11. Fuel Pressure gauge
12. Master electrical switch
13. Magneto switches
14. Throttle
15. High altitude throttle
16. Supercharger drive
17. Priming fuel pump
18. Starter pull handle
19. Oil Pressure gauge
20. Radiator flap handle
21. Clock
22. Coolant temperature gauge
23. Oil-dual temperature gauge
24. Tachometer
25. Heating nozzle switch
26. Heating nozzle visual indicator
27. Undercarriage locking indicator
28. Prop pitch change switch
29. Prop pitch indiator
30. Navigation lights switch
31. Instrument panel light switch
32. Dimmer control
33. Manifold pressure gauge
34. Canopy locking handle
35. Canopy window latch
36. Seat adjustment handle
37. Lap harness adjustment handle
38. Variometer
39. Flap operating wheel
40. Tailplane pitch adjustment wheel
41. Tailplane pitch visual indicator
42. Undercarriage mechanical indicator
43. Cabin vent lever
44. Turn and bank indicator
45. Stiffness control
46. Fuel contents gauge
47. Hand knob for pump for fuel contents
48. Emergency release for undercarriage
49. Master cut-out buttom for electrics
50. Canopy jettison handle
51. Magnetic compass
52. Air speeed indicator
53. Fine and course altimeter
54. Fuse panel



Messerschmitt Bf 109 C-1

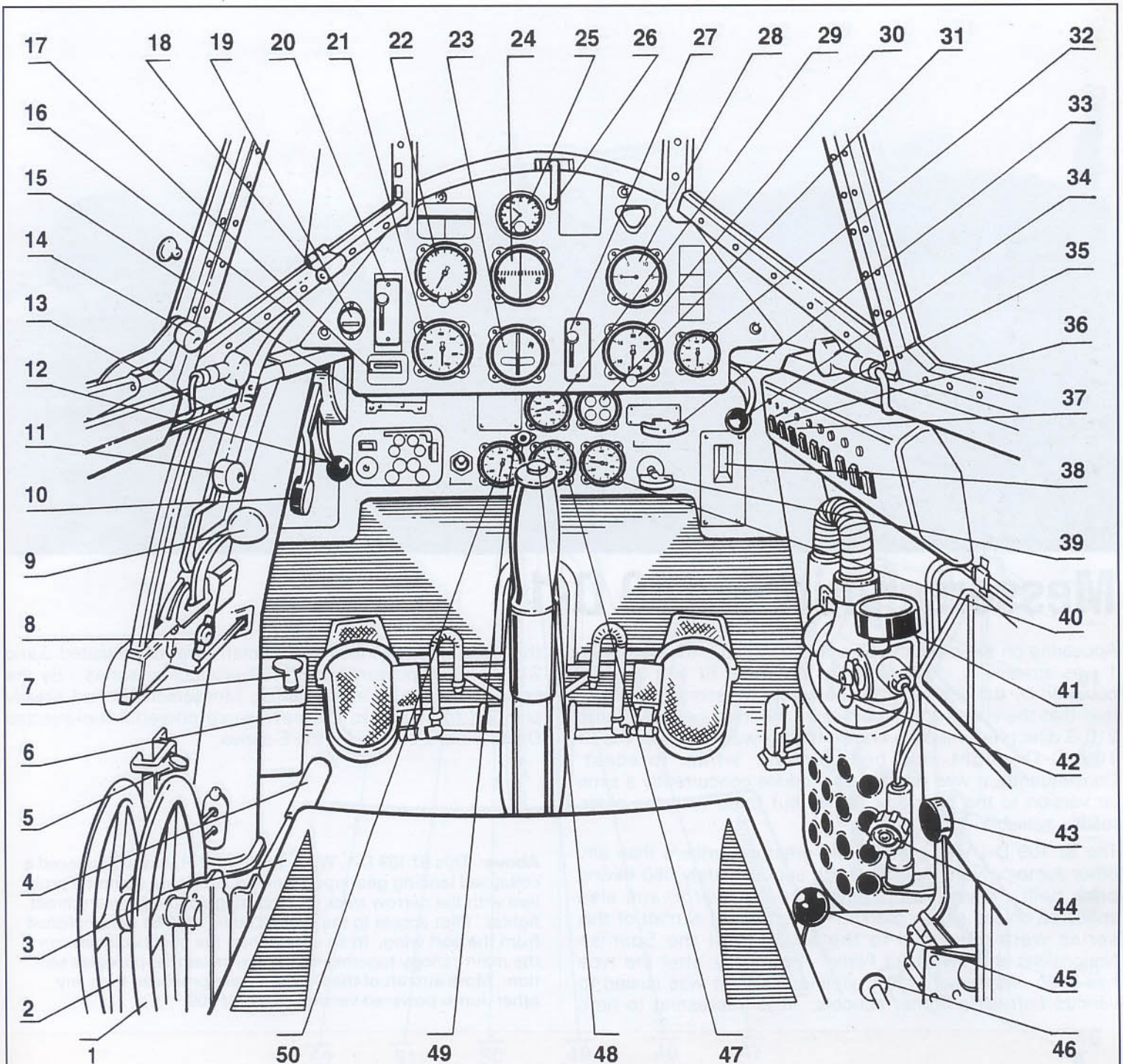
Externally similar to the earlier B-1, the Bf 109 C-1 was to have received the new Jumo 210 G direct fuel-injection engine. However, flight trials with two prototype aircraft, the Bf 109 V7, W.Nr. 881, D-IJHA, and the Bf 109 V9, W.Nr. 883, D-IPLU, each powered by early examples of the Jumo 210 G, were unexpectedly protracted. The Junkers Jumo 210 G held the distinction of being the world's first production aviation engine with direct fuel injection. Development of this engine began in 1935 and offered great promise to propeller-driven aircraft, which, up to then, had to rely solely upon carburetor-fed fuel delivery to the engine. Since it was obvious this new engine would not be ready in time, it was therefore decided to fit a limited number of Bf 109 C-1 airframes with the older carburetor-equipped Jumo 210 D engine driving a metal, two-bladed, variable-pitch, VDM 9-11072A propeller. When the first Bf 109 C-1s appeared late in 1937, the most notable feature of this series was the addition of two wing-mounted MG 17 machine guns with 420 rpg supplementing the two similar weapons mounted over the engine. One of the early complaints voiced by fighter pilots was the inadequacy of the B-series weaponry. Interestingly, the original armament plan for the B-0 pre-production series specified four MG 17s, two in the fuselage and two in the wings. But, prior to production this was amended down to three of these 7.9 mm machine guns because of several design considerations that had yet to be resolved. In addition, the engine-mounted machine gun installed in the B-1 series was not fully reliable. When this weapon malfunctioned, the pilot's weaponry was reduced to only the two small-caliber machine guns. Therefore, when the C-1 appeared with double the firepower of its predecessor, it was viewed as a significant step in the right direction. The C-1 also carried the usual oxygen supply, with an on-demand regulator, a Revi C 12 B or C gun sight and FuG VII radio equipment. As in the B-1 series, no pilot armor was fitted to this fighter.

Since the Jumo 210 G was not ready in time for the C-1, and since Messerschmitt had planned to concurrently produce a similar series (the Bf 109 D-series) powered by the readily available Jumo 210 D, it decided to restrict production of the C-1 to less than sixty aircraft, each fitted with the older Jumo 210 D. Of these, one dozen were sent to Spain for operations with the Legion Condor, while the remainder were issued to the *Luftwaffe*.



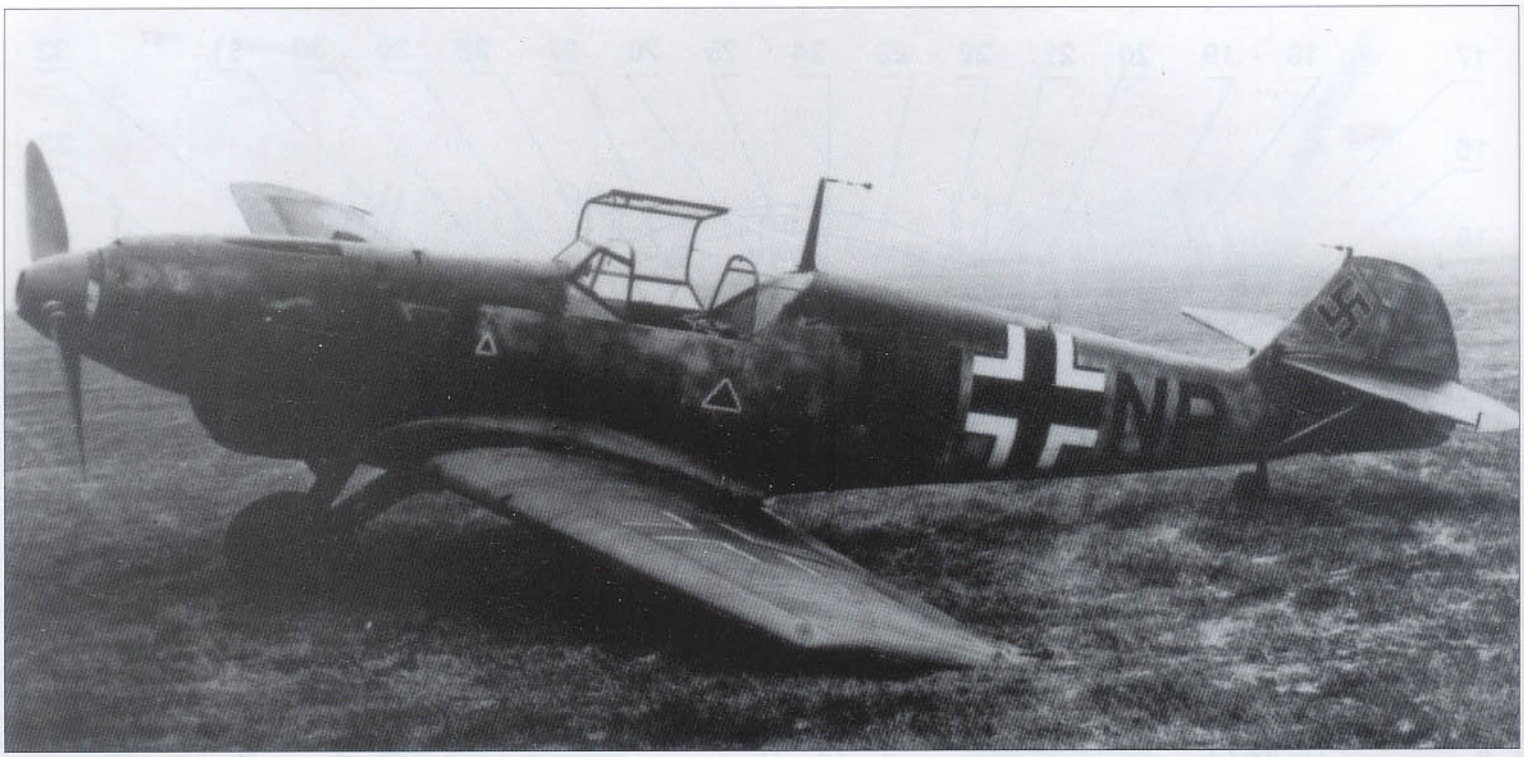
Above: This Bf 109 C-1 was one of 59 aircraft of this series to be produced. It was originally planned to use the fuel-injected Jumo 210 G in this series, but owing to this engines protracted development, most were, instead, fitted with the carburetor-fed Jumo 210 D.

Left: The Jumo 210 D was a 12-cylinder, 21 litre, water-cooled 60° Vee-type engine which developed 730 hp for take off.



Bf 109 C-1 Cockpit

1. Tailplane adjustment wheel
2. Landing flap operating wheel
3. Pilot's seat
4. Seat height adjustment lever
5. Visual indicator for tailplane pitch angle
6. Engine fuel priming tank
7. Priming pump handle
8. Throttle lock friction nut
9. Supercharger selector handle
10. Coolant radiator flap handle
11. Throttle
12. Fuel shut-off lever
13. Engine operating data
14. Cockpit canopy locking handle
15. Starter pull handle
16. Cockpit canopy jettison handle
17. Visual indicator for pitot head heater
18. Cockpit window frame
19. Master cut out button for electrics
20. Magneto switches
21. Air speed indicator
22. Altimeter
23. Turn and bank indicator
24. Magnetic compass
25. Chronometer
26. Cockpit air vent lever
27. Propeller pitch change lever
28. Manifold pressure gauge
29. Dual fuel and oil pressure gauge
30. Tachometer
31. Electrical indicator for gear position
32. Propeller pitch indicator
33. Undercarriage release handle
34. Fuel hand pump
35. Navigation lights switch
36. Instrument panel lights switch
37. Pitot heating switch
38. Mechanical indicator for gear
39. Emergency undercarriage release handle
40. Engine coolant temperature gauge
41. Oxygen pressure gauge
42. Oxygen shut-off switch
43. Tailwheel lock
44. Oxygen system master valve
45. Lap harness adjustment handle
46. Hand lever for auto-switch
47. Oil temperature gauge
48. Control column
49. Low fuel warning light
50. Fuel contents gauge

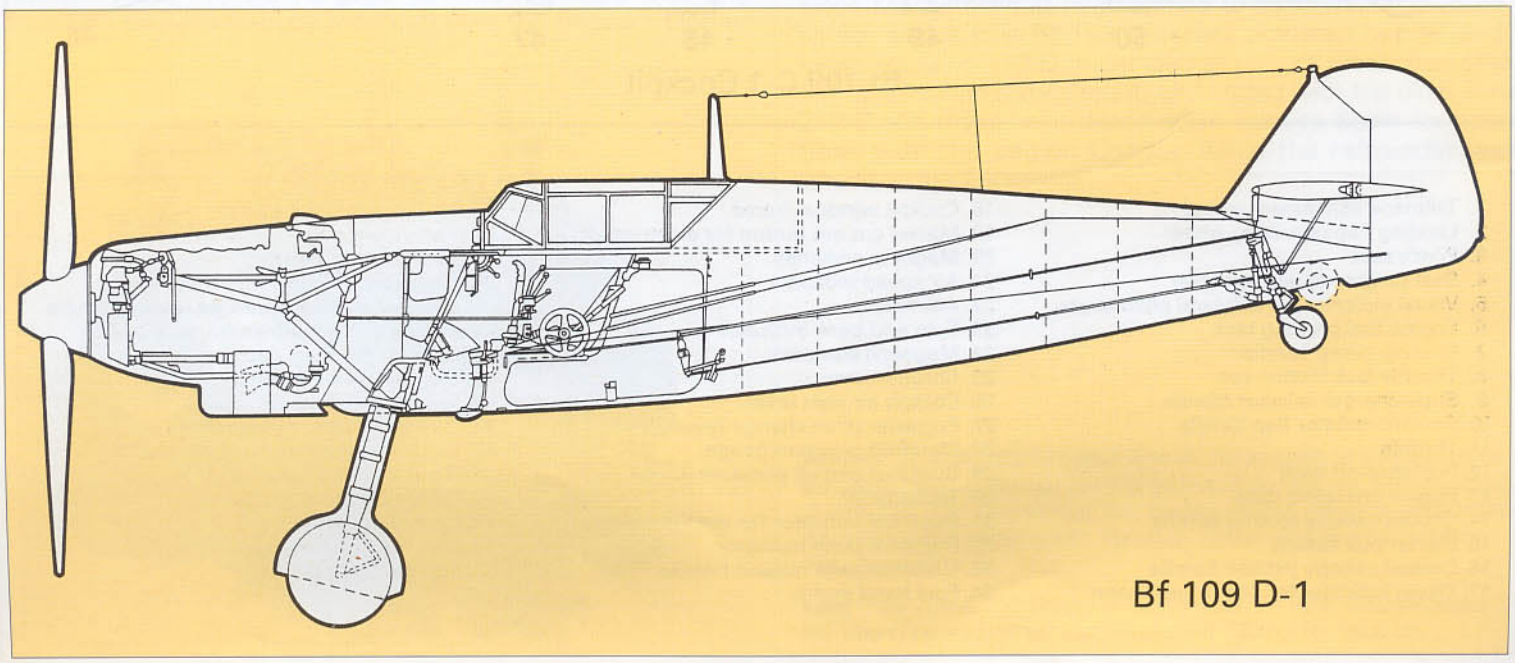


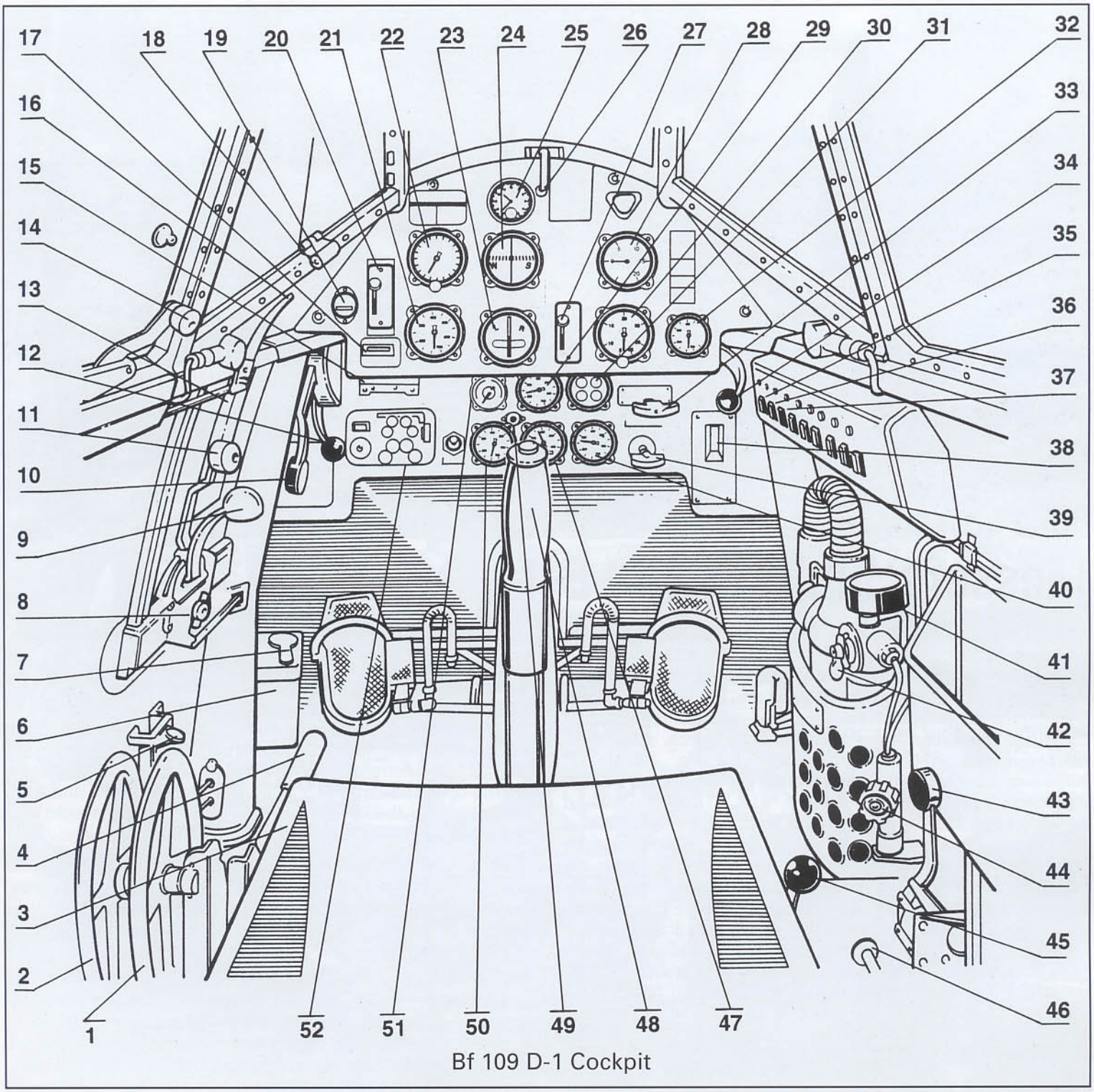
Messerschmitt Bf 109 D-1

Appearing on the production lines late in 1937, the Bf 109 D-1 was essentially identical to the definitive Bf 109 C-1 and powered by the Juno 210 D. Early on, Messerschmitt realized that there was a real possibility the long-awaited Jumo 210 G direct-fuel-injection engine (which was to power the Bf 109 C-1) might not be available when forecast. Consequently, it was decided to produce concurrently a similar version to the planned C-series but fitted with the older, readily available, Jumo 210D.

The Bf 109 D-1 was produced in greater numbers than any other Jumo-powered version, with approximately 650 having been built. It was supplied to the *Luftwaffe*, and also appeared on the export market. A number of aircraft of this series were delivered to the air arms of the Spanish Nationalists and Swiss Air Force. Eventually, after the type had been withdrawn from front-line duties, it was issued to various *Luftwaffe* fighter schools. It is interesting to note that, apart from various test aircraft, the long-awaited Jumo 210 G never powered a Bf 109 production series. By the time it was available in quantity, Messerschmitt had already planned to switch to the new, more powerful fuel-injected Daimler-Benz engine for the E-series.

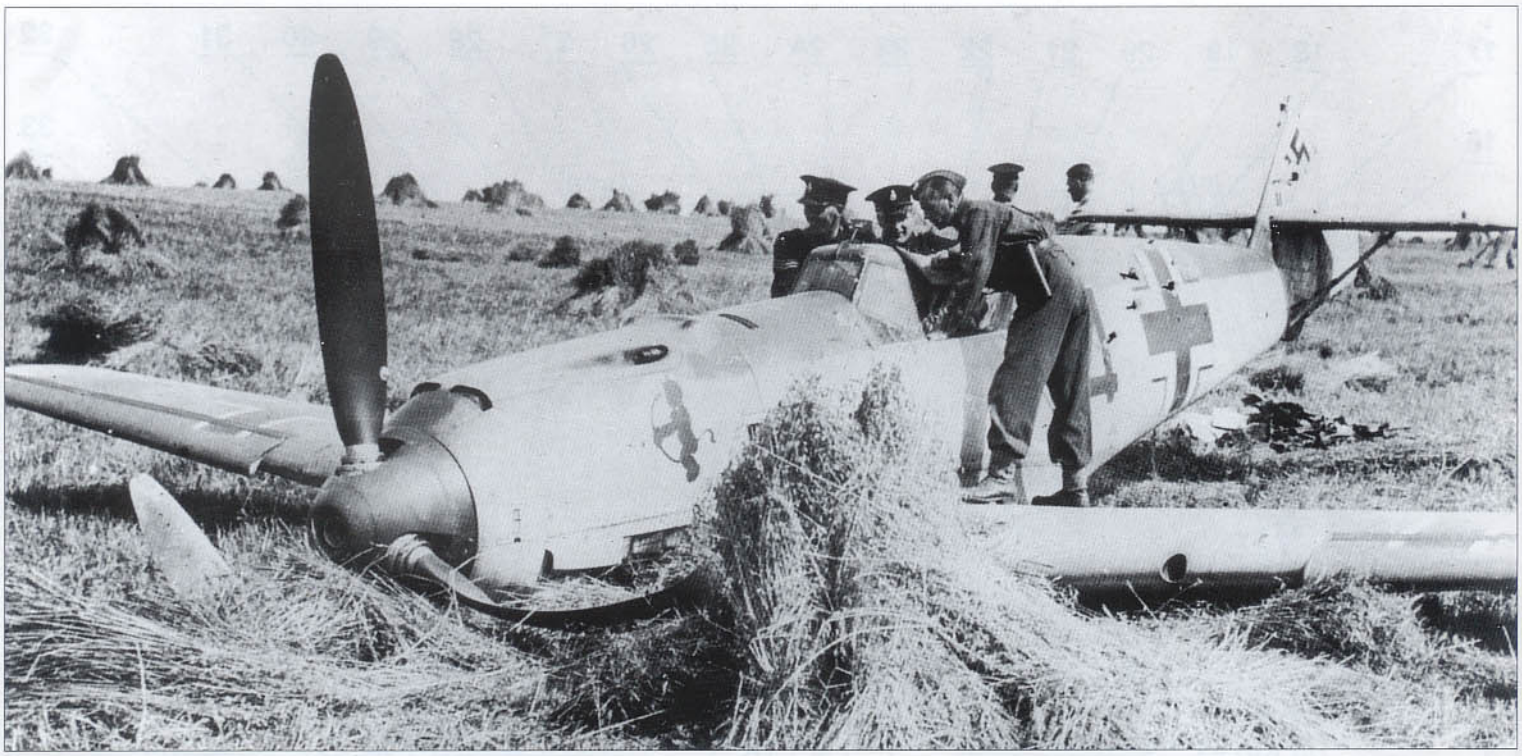
Above: This Bf 109 D-1, W.Nr. 2453, TJ+NR, has experienced a collapsed landing gear upon landing, an all too common problem with the narrow track undercarriage of the Messerschmitt fighter. Pilot access to the cockpit could only be accomplished from the port wing. In an emergency, the pilot could jettison the main canopy together with the smaller rear plexiglas section. More aircraft of the D-series were produced than any other Jumo-powered version of the Bf 109.





Bf 109 D-1 Cockpit

1. Tailplane pitch adjustment wheel
2. Landing flap operating wheel
3. Pilot's seat
4. Seat height adjustment lever
5. Visual indicator for tailplane pitch angle
6. Engine fuel priming tank
7. Priming pump handle
8. Throttle lock friction nut
9. Supercharger selector handle
10. Coolant radiator flap handle
11. Throttle
12. Fuel shut-off lever
13. Engine operating data card
14. Cockpit canopy locking handle
15. Starter pull handle
16. Cockpit canopy jettison handle
17. Visual indicator for pitot head heater
18. Cockpit window frame
19. Master cut out switch
20. Magneto switches
21. Air speed indicator
22. Altimeter
23. Turn and bank indicator
24. Magnetic compass
25. Chronometer
26. Cockpit air vent lever
27. Propeller pitch change lever
28. Manifold pressure gauge
29. Dual fuel and oil pressure gauge
30. Tachometer
31. Electrical indicator for gear position
32. Propeller pitch indicator
33. Undercarriage release handle
34. Fuel hand pump
35. Navigation lights switch
36. Instrument panel lights switch
37. Pitot heating switch
38. Mechanical indicator for gear
39. Emergency release handle for gear
40. Engine coolant temperature gauge
41. Oxygen pressure gauge
42. Oxygen shut-off cock
43. Tailwheel lock
44. Oxygen system master valve
45. Flap harness adjustment handle
46. Hand lever for auto-switch
47. Pressure head for oil temperature gauge
48. Control column
49. Low fuel warning light
50. Fuel contents gauge
51. Fuel pressure gauge
52. Ammunition counters



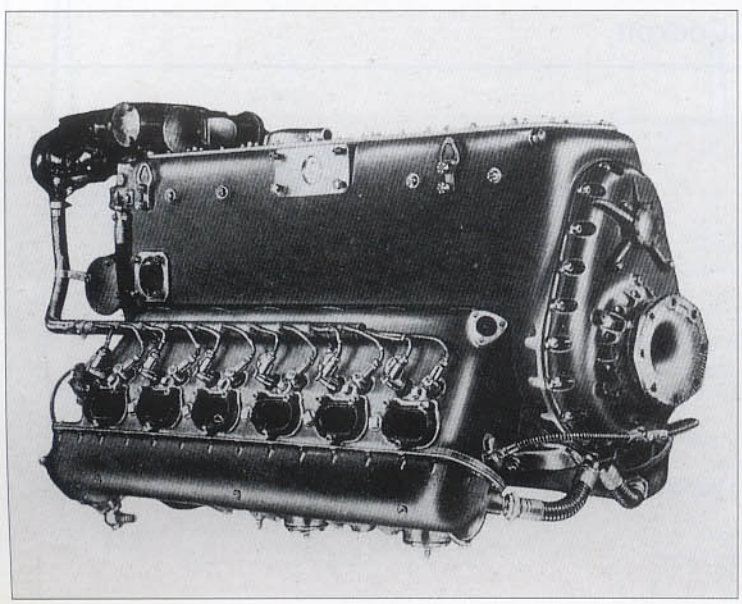
Messerschmitt Bf 109 E-1

Toward the end of 1938, the Bf 109 E-1 series appeared, powered by the new fuel-injected Daimler-Benz DB 601 A-1, developing 1,100 hp and driving a metal, three-bladed, electrically actuated, constant-speed VDM 9-11081A propeller. This new fighter series was a substantial improvement over the older Jumo-powered 109s which it began to replace in all front-line units of the *Luftwaffe*. Several Bf 109s participated in the development of the Emil series, and these included the Bf 109 V13, V14, V15, V18, V19 and possibly the V20. Each was fitted with an early example of the DB 601A and extensively flight-tested. Some sources have indicated that some of these test aircraft were initially fitted with a DB 600. This remains a possibility, but surviving documentation does not seem to support this conclusion. The DB 600 was similar in size and shape to the improved DB 601, but was not fuel-injected and was essentially unsuited for modern fighters. Like the earlier Bf 109 D-1, the E-1 was equipped with an armament of four MG 17 machine guns and carried internal equipment essentially unchanged from the earlier Messerschmitt fighters.

In the cockpit, the basic layout remain closely patterned after earlier variants. Engine and flight instruments were grouped in a similar pattern as was used on earlier series of the Bf 109. In addition, a main weapon switch, machine gun selector switches and four ammunition counters were mounted on the main instrument panel. On the control column were a thumb-operated button for firing the wing MG 17s, and a finger trigger for the cowl MG 17s. A Revi 12 C gun sight was mounted off-center to the right of the instrument panel.

Two oxygen bottles were mounted in the roof of the fuel tank compartment immediately aft of the cockpit. A pressure-and-supply regulator with its gauge and controls was located on the right of the cockpit. The filler point was located externally on the right side of the fuselage.

There was no pilot or fuel tank protection in the form of armor plate fitted to the E-1 series, and the cockpit windscreen, canopy and framing were unchanged from the earlier D-series. However, during and immediately following the Battle of Britain, some surviving Emils of the E-1 series were retroactively fitted with bolt-on bullet-resistant windscreens when it became clear that pilot protection was essential.



Above: This Bf 109 E-1, W.Nr. 3367, of 2./JG 52, piloted by *Uffz.* Leo Zaunbrecher, was forced down near Berwick on August 12, 1940, by RAF Pilot Officer J.A.P. McClintock of No. 615 Squadron. *Uffz.* Zaunbrecher was wounded in his shoulder and taken prisoner.

Left: Powerplant for the Bf 109 E-1 was the DB 601 A, a 33.9 litre, 12-cylinder, liquid-cooled, fuel-injected engine. First appearing in 1937, it was a dependable engine developing 1,100 hp for take off at 2,400 rpm.

Right opposite: A general view of the cockpit of Bf 109 E-1, W.Nr. 2804, AJ+YH (incorrect fictional postwar code), on display at the Deutsches Museum in Munich, Germany.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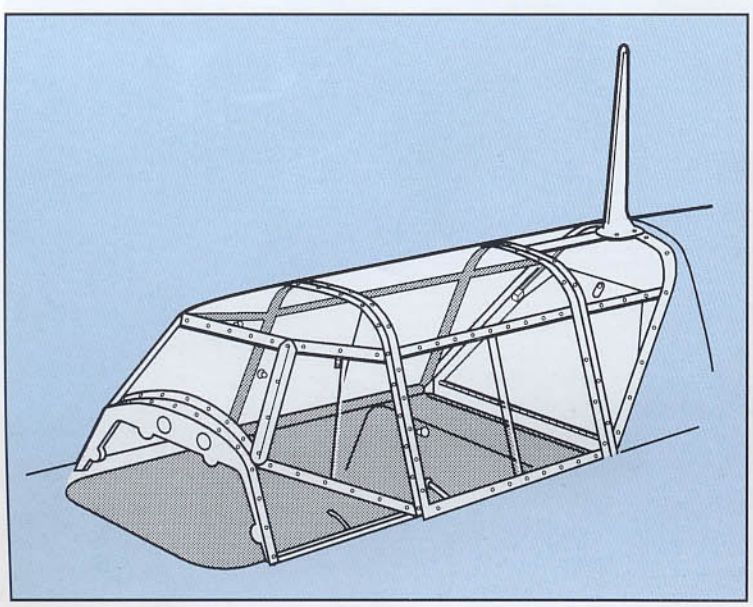
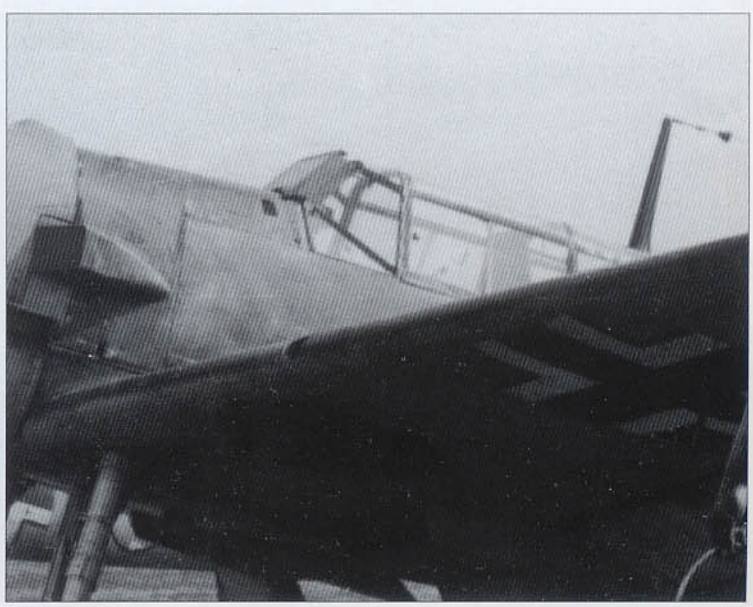
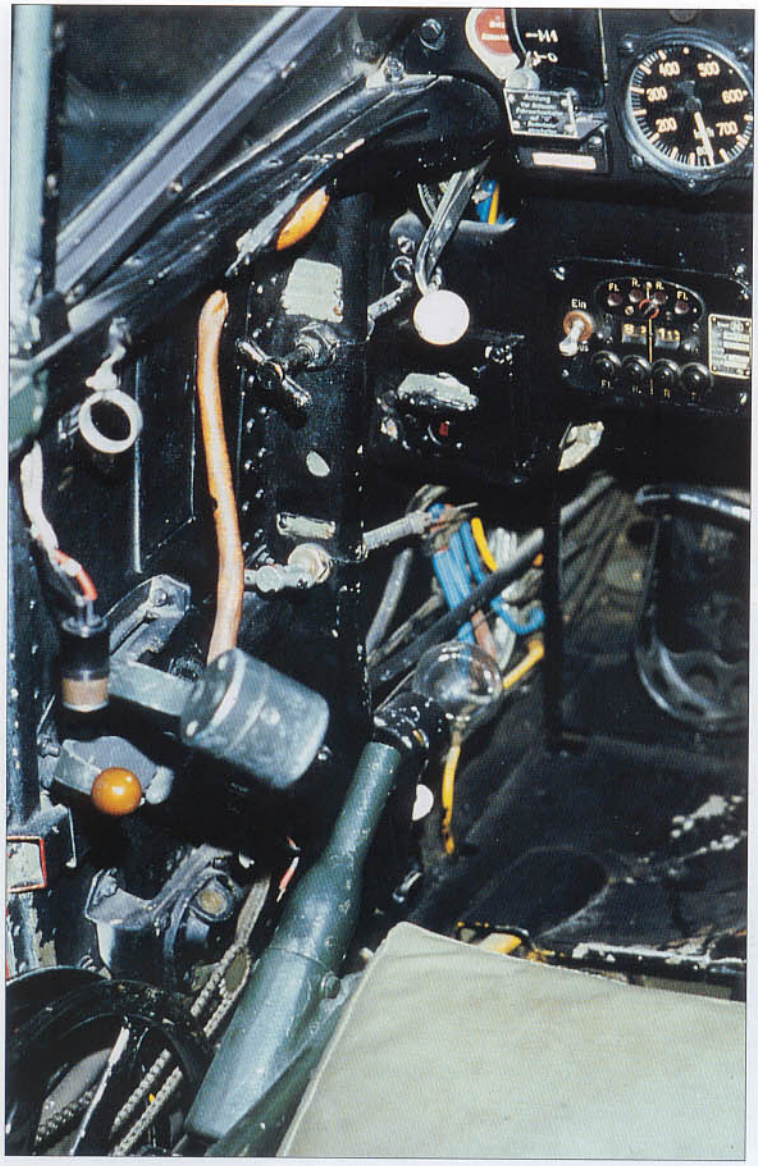
Top: Another view of the Bf 109 E-1 on exhibit at the Deutsches Museum showing flight and engine instruments arranged similar to the diagram shown on page 60. Like most German fighters of the period, the color of the instrument panel was officially given as Color 66 Black-Gray. This particular example was built by Messerschmitt on July 18, 1939 and later exported to Spain. It was acquired by the Deutsches Museum in 1959 and the exterior has been repainted several times. The cockpit is, however, original in most respects.

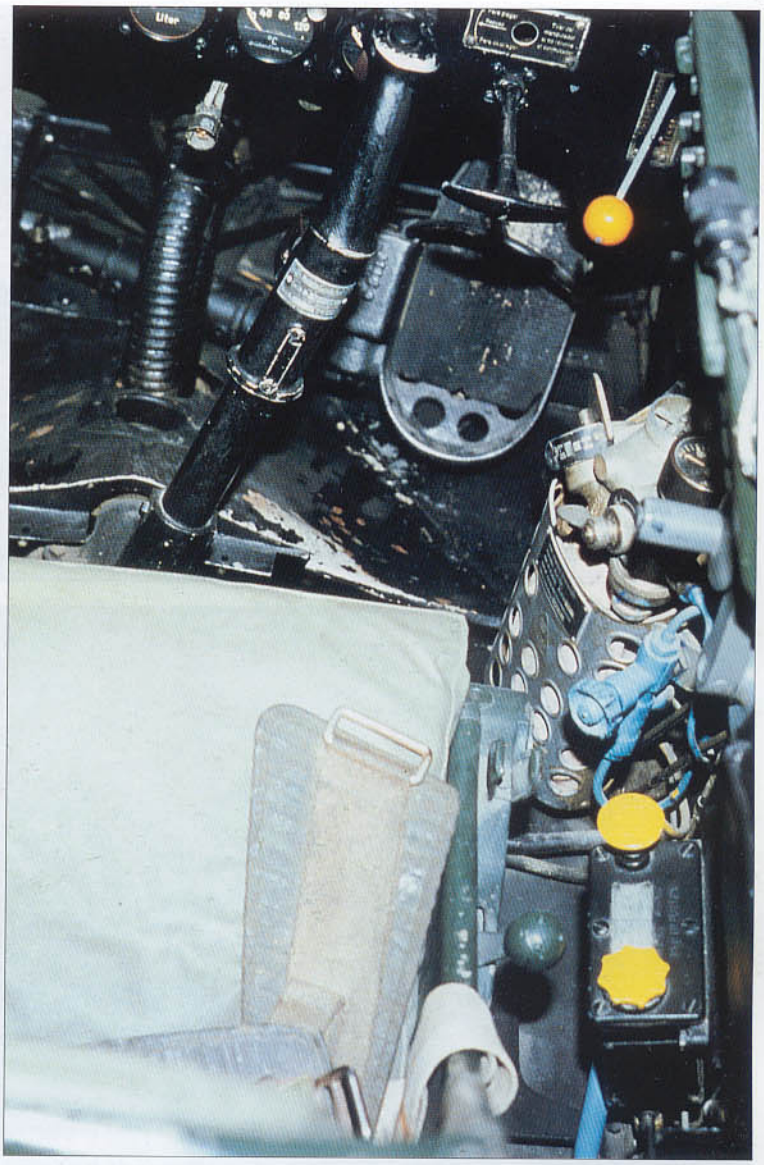
Below left: An official drawing of the three-piece canopy utilized by the Bf 109 E-1, E-3 and early examples of the E-4 series. It afforded good visibility in all directions except to the rear. Some pilots customized their aircraft by installing a small rectangular rear view mirror on top of the forward section.

Below right: During the Battle of Britain, it was quickly discovered that the simple plexiglas panels to the canopy afforded the pilot no protection. In an effort to address this weakness, a heavy, bullet-resistant glass panel was retroactively attached to the windscreen of many front-line fighters, including this example. Note that additional shoulder and head armor plate has also been retroactively installed.





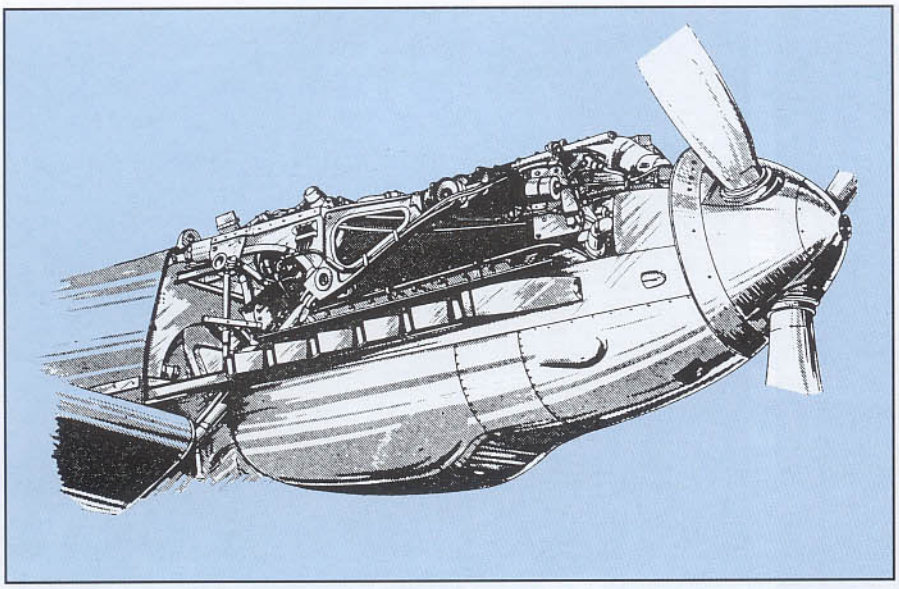


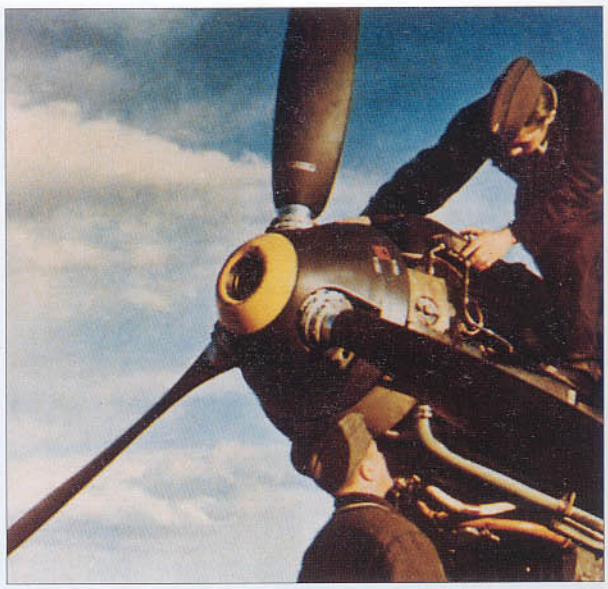


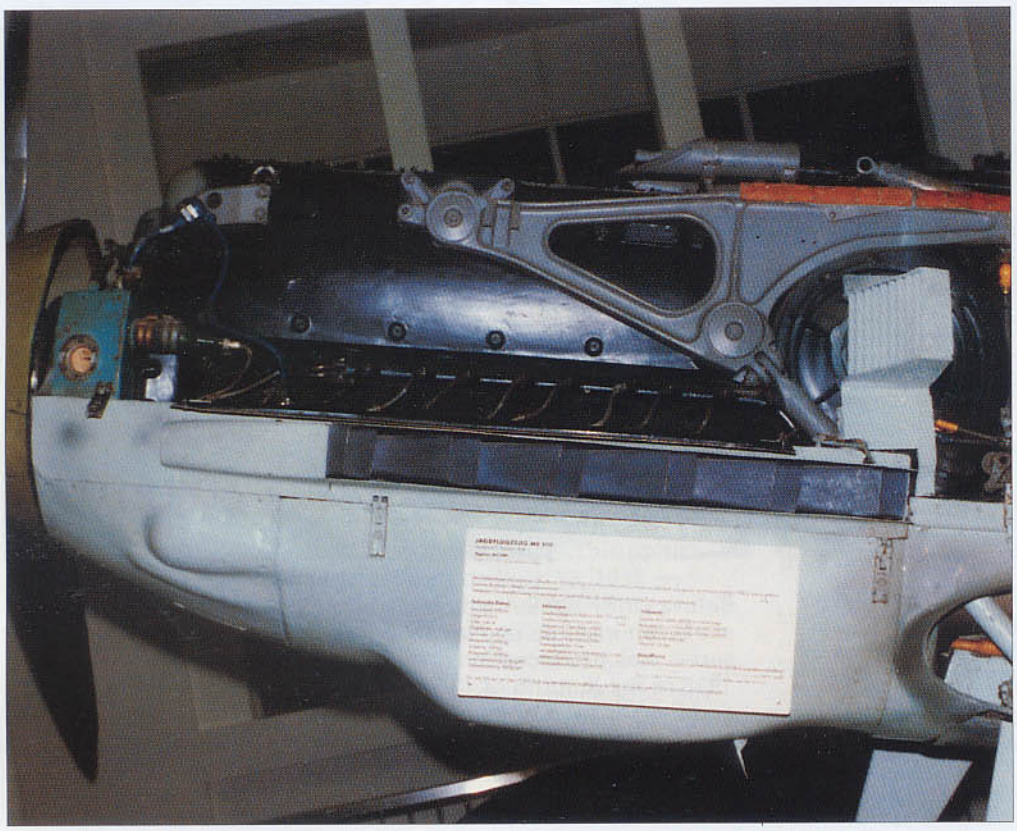
Above left: A close-up of the left side of the Bf 109 E-1s cockpit showing several features including the throttle and trim wheel.

Above right: A close-up of the right side of the E-1s cockpit showing yellow handled filter pump control on the lower instrument panel. On the side is the blue oxygen valve followed by the fuel injection primer pump with yellow handle.

Below: A Bf 109 E-1 attached to 3./JG 51 with over-size national aircraft insignia applied to the top side of wings. The E-1 series was produced in considerable numbers from the end of 1938 to the autumn of 1940 when it was superseded by the E-3 and E-4 series. Surviving examples of the E-1 were then transferred to various fighter schools as advanced trainers.







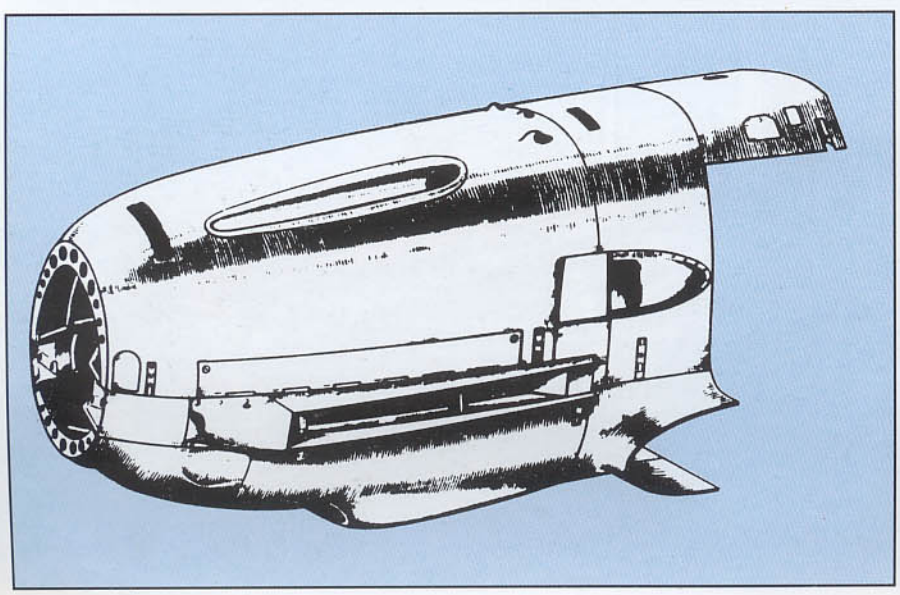
Top left: Artist sketch of the starboard side of the engine of a Bf 109 E-1 with the upper cowl removed.

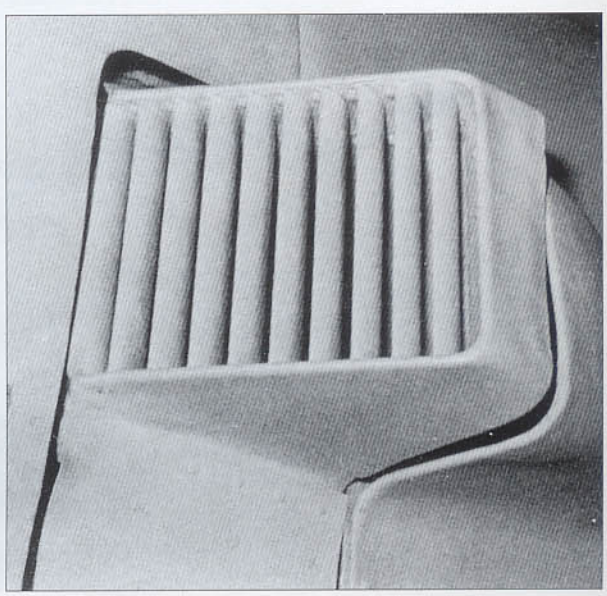
Above: Close-up of the VDM 9-11081A propeller and spinner. Most early examples of the Emil series (as the E-series was known), were equipped with open spinners. This allowed for extra cooling of the engine. The original plan to install an engine-mounted cannon, firing through the spinner hub, fell through after protracted tests failed to correct jamming problems.

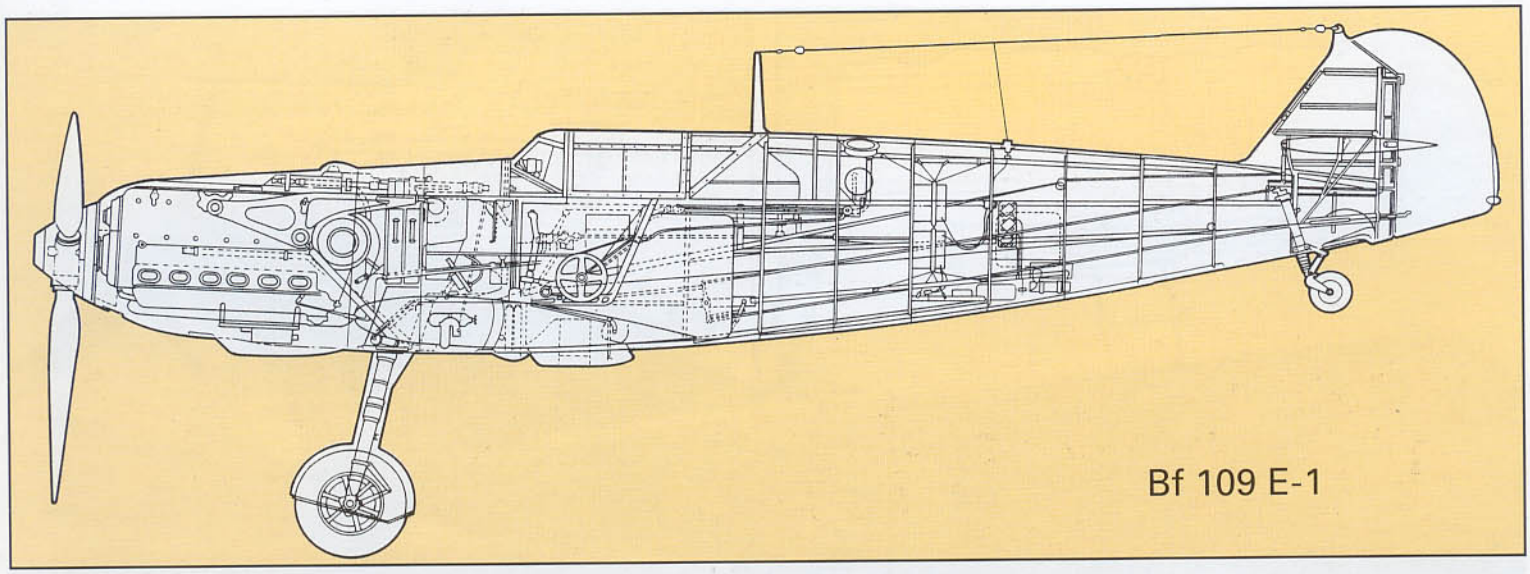
Left: Close-up of the port side of the DB 601 A installed in the Emil owned by the Deutsches Museum.

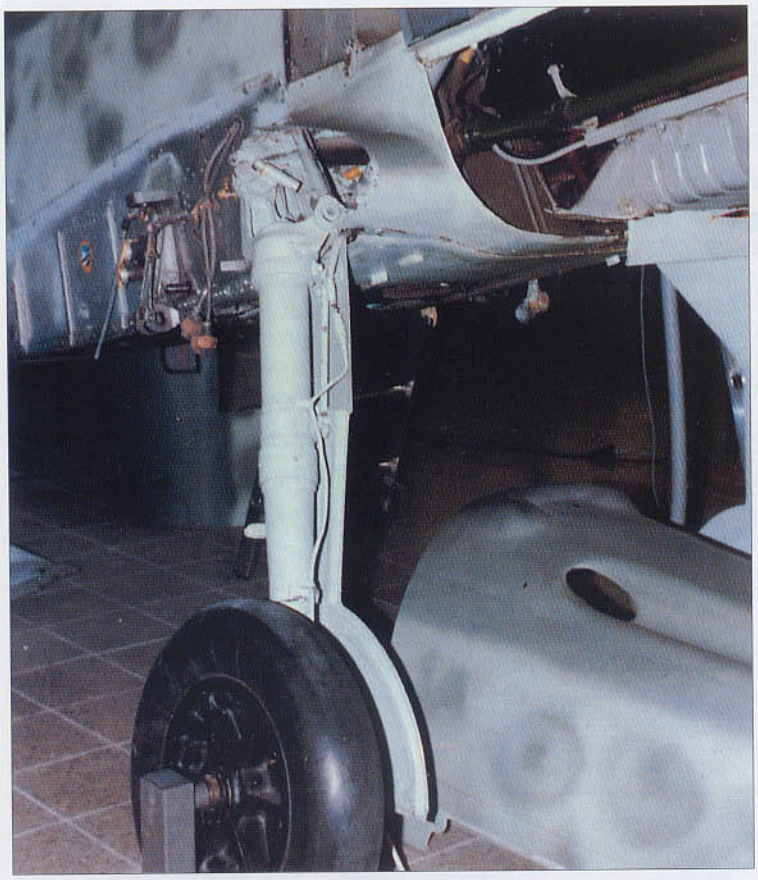
Below left: One of the characteristics of the German Bf 109, was the relatively simple method of attaching the nose cowling to the airframe through quick-release pressure clips.

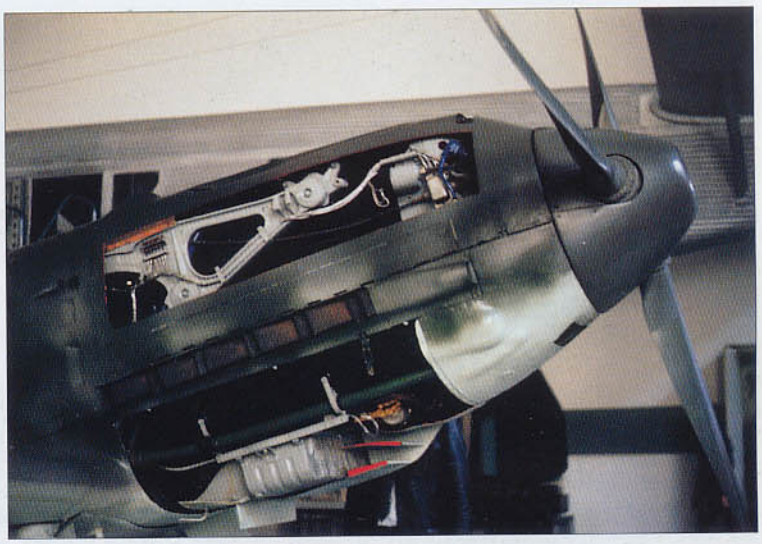
Below: Close-up of the multi-vained opening to the supercharger intake employed on all versions of the E-series.





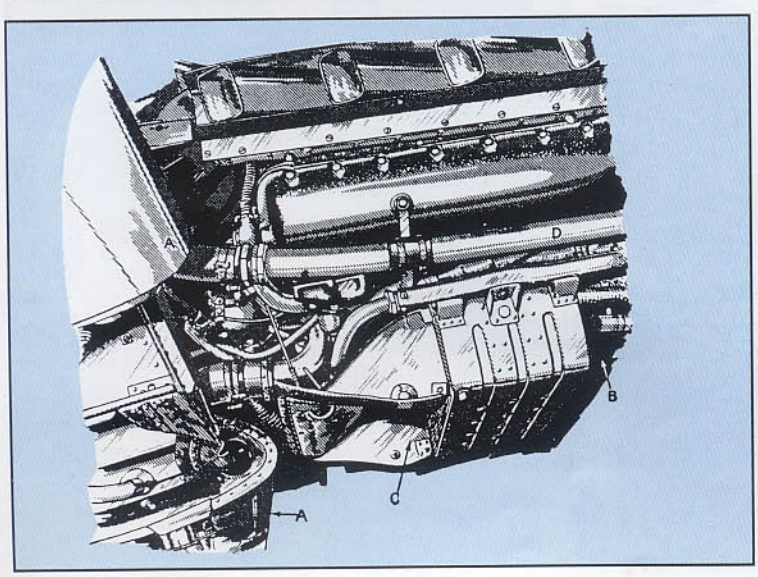


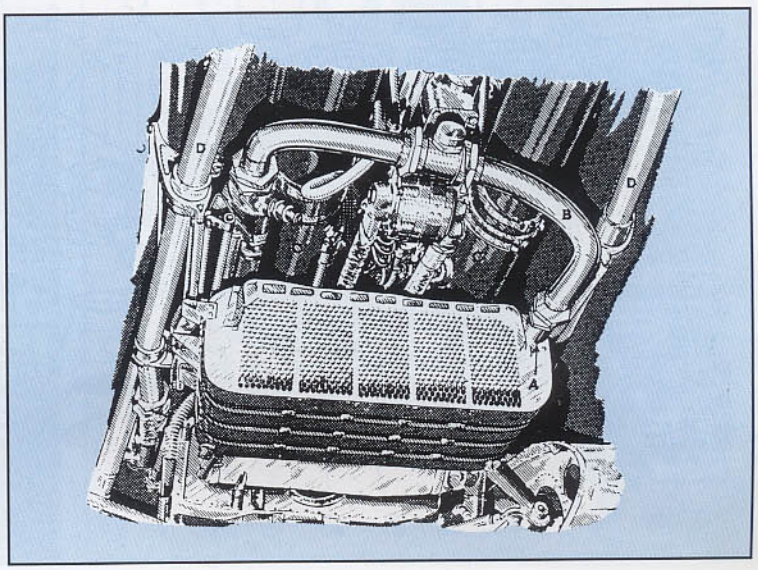




Left and above: Two close-up views of the Bf 109 E-1 owned by the Deutsches Museum showing the starboard gear leg and various features of the engine and cooling system.

Below: Two sketches of the oil cooler and related plumbing positioned directly beneath the engine.



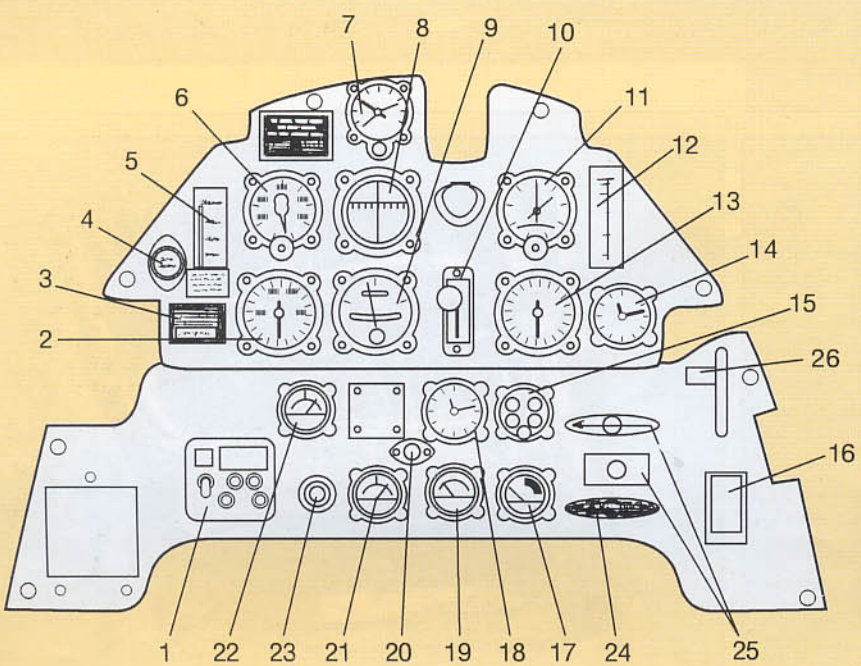


Messerschmitt Bf 109 E-3

Contrary to popular belief, only a limited number of Bf 109 E-3s were manufactured, and only a handful participated in the Battle of Britain. This limited production variant, introduced at the end of 1938, was identical to the E-1 series, apart from armament. The small-caliber MG 17 machine guns installed in the wings of the E-1 were replaced by the much larger-caliber 20 mm MG FF cannon. The MG 17, manufactured by Rheinmetall-Borsig, was capable of firing 1,100 rounds per minute, with a muzzle velocity of 2,000 ft/sec, while the larger MG FF, also manufactured by Rheinmetall-Borsig under license agreement with the Swiss firm of Oerlikon, fired only 520 rpm, but offered a muzzle velocity of 1,969 ft/sec. The development aircraft for this aircraft cannon installation was thought to be the Bf 109 V12, DF+IX, which was powered by a Jumo 210 D.

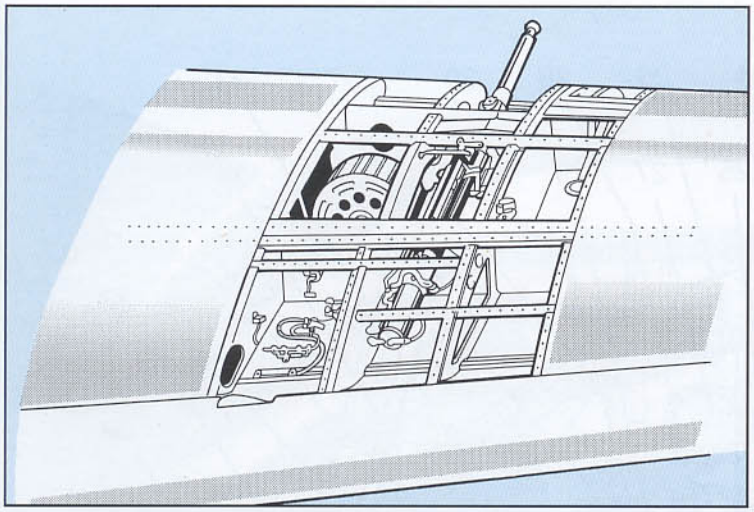
As with the E-1 series, the E-3 was classified as a light fighter without pilot armor, bullet-resistant windscreen, or self-sealing fuel tank. However, it is possible some aircraft of this series may have been retro-fitted with some form of pilot armor before being withdrawn from operations.

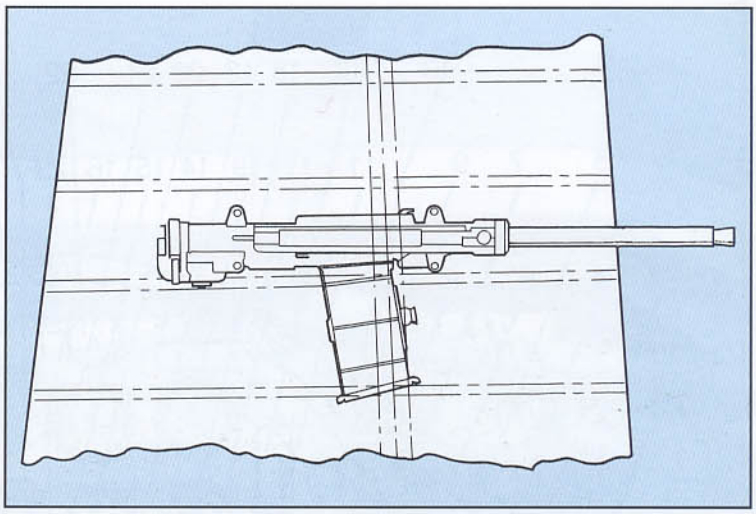
Above: This Bf 109 E-3, W.Nr. 1304, white 1 of I./JG 76 (later II./JG 54) ,was the first complete example of this variant to fall into Allied hands when it made a forced landing at Woerth, France on November 22, 1939. It is shown here in British national aircraft insignia following a hurried flight to England in May 1940.



Bf 109 E-3 Instrument Panel

1. Weapon selector box
2. Air speed indicator
3. Pitot head heating warning light
4. Master cut-out button for electrics
5. Ignition switch
6. Altimeter
7. Clock
8. Compass
9. Turn and bank indicator
10. Prop pitch control if not on throttle
11. Manifold pressure gauge
12. Deviation table
13. Tachometer
14. Prop pitch indicator
15. Undercarriage position indicator
16. Mech. gear position indicator
17. Coolant temperature gauge
18. Fuel + oil pressure gauge
19. Oil temperature gauge
20. Low fuel warning light
21. Fuel contents gauge
22. Dimmer rheostat
23. Weapons cut-off switch
24. Emergency gear control lever
25. Undercarriage control lever + placard
26. Fuel fliter hand pump



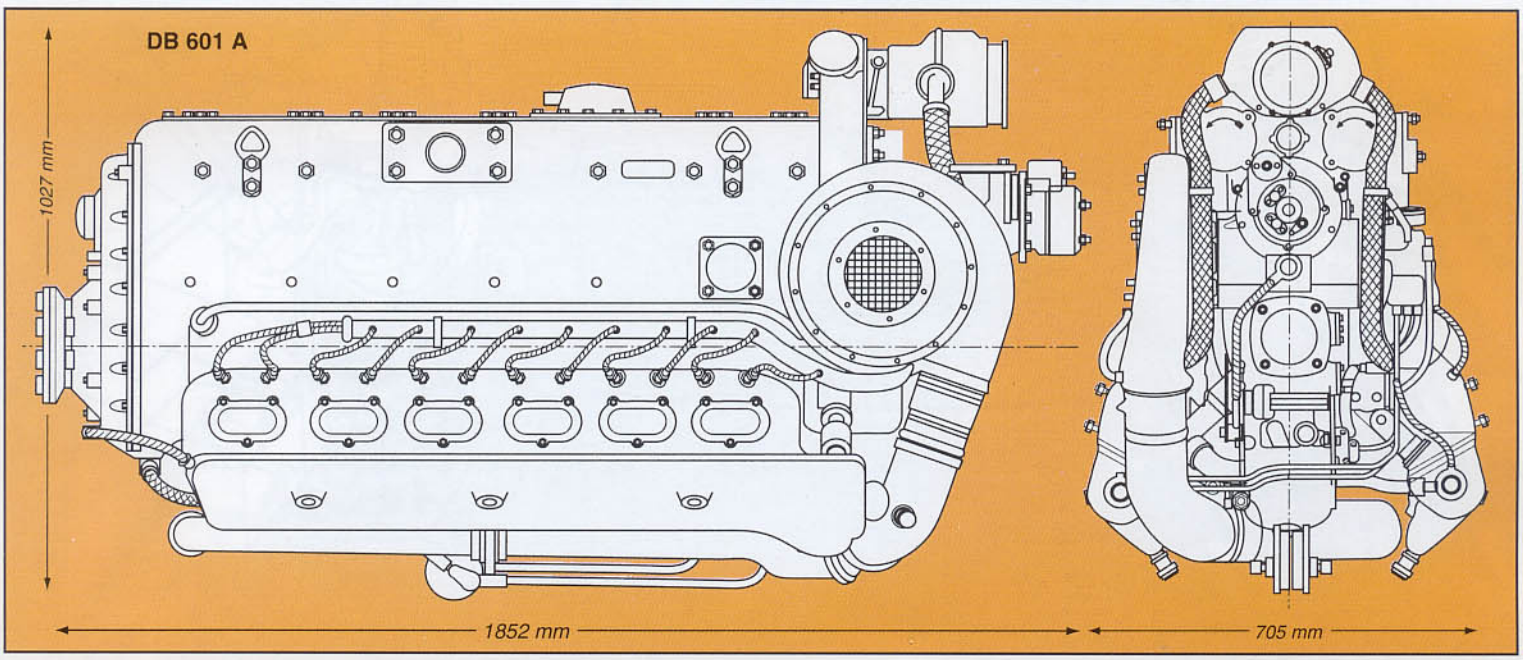


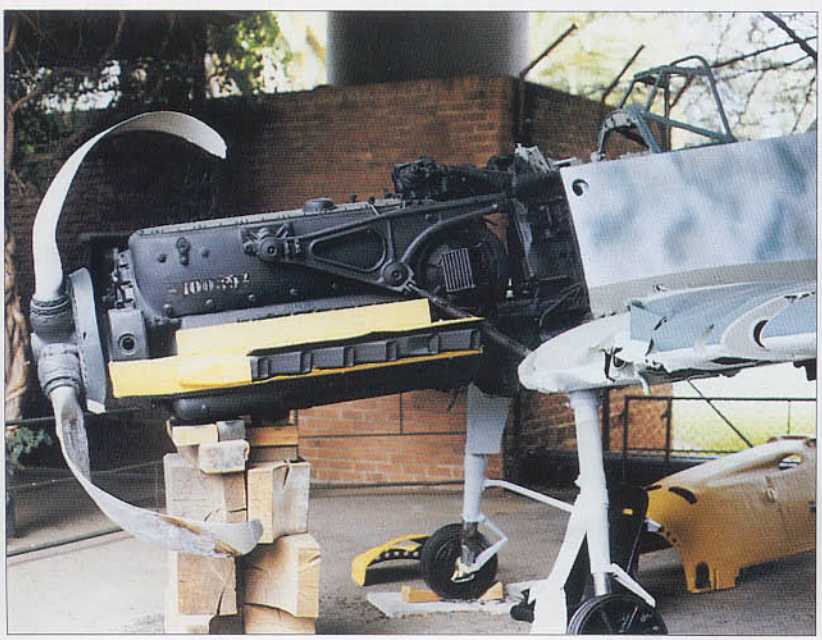
Above left and right: Details of the wing-mounted 20 mm MG FF complete with its 60-round drums.

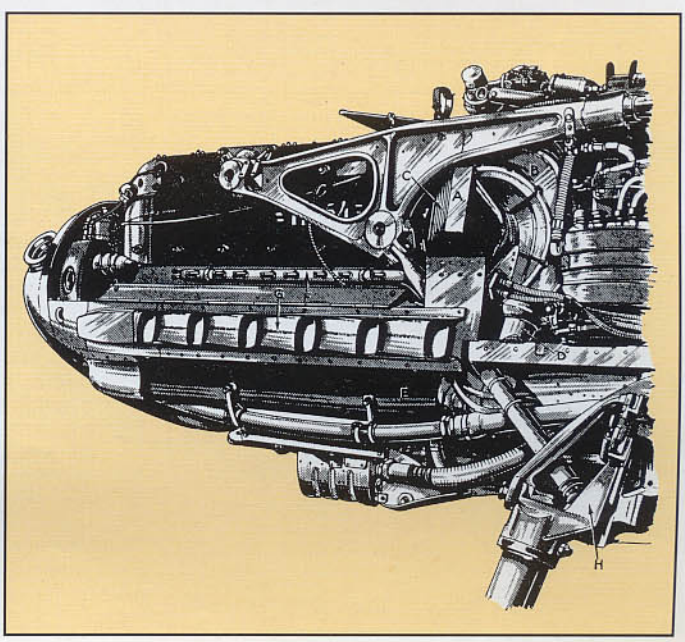
Below: Side and rear views of the DB 601 A which powered the Bf 109 E-1 and E-3 series.

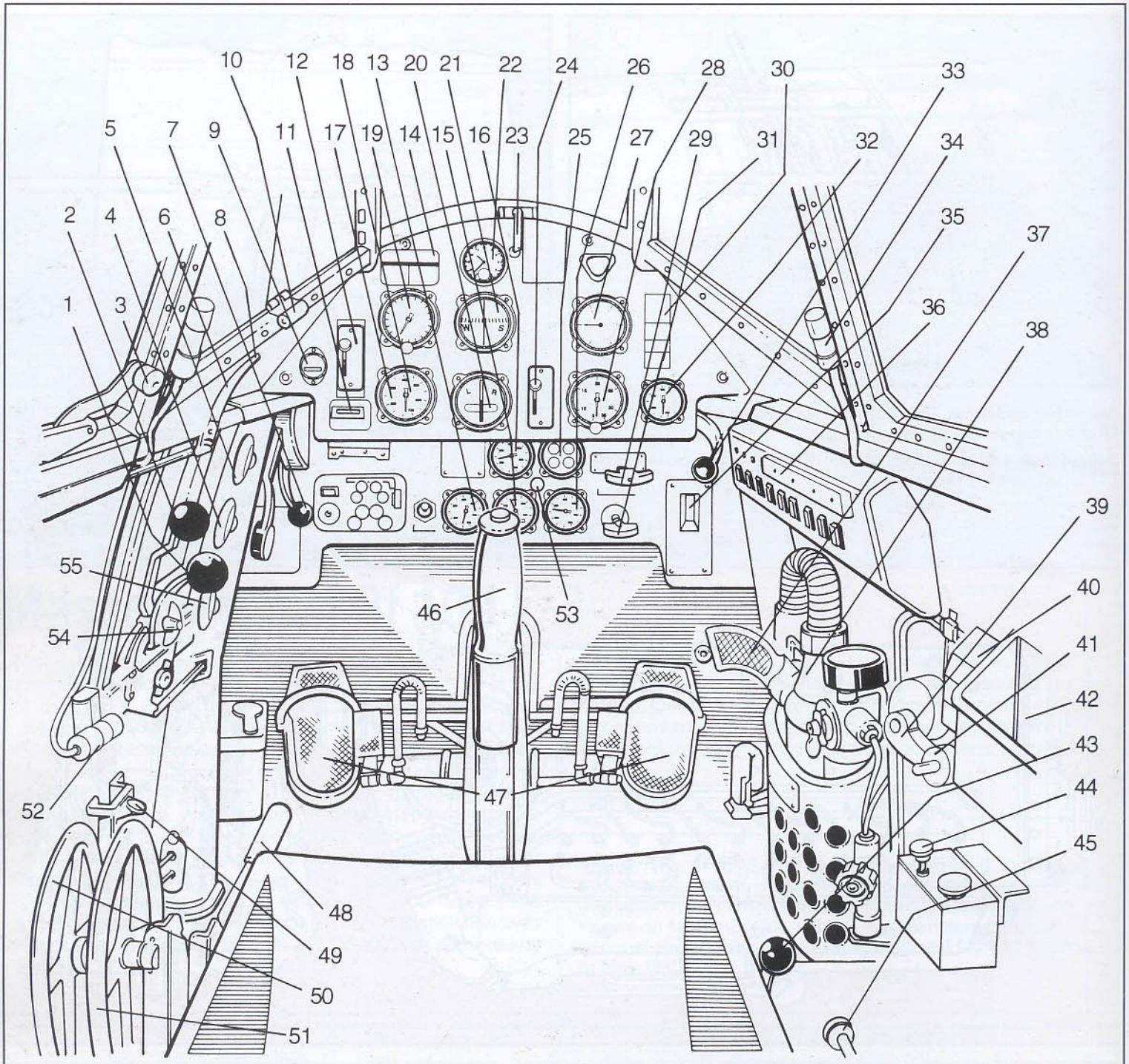
Bottom left: Museum remains of Bf 109 E-3, W.Nr. 1289, SH+EA, on exhibit in South Africa. It was flown by *Uffz.* Heinz Wolf of 2./JG 26 when crash-landed at Udimore, Sussex, on November 28, 1940.

Bottom Right: Sketch of the port side of the engine area showing the rugged engine bearer arm.



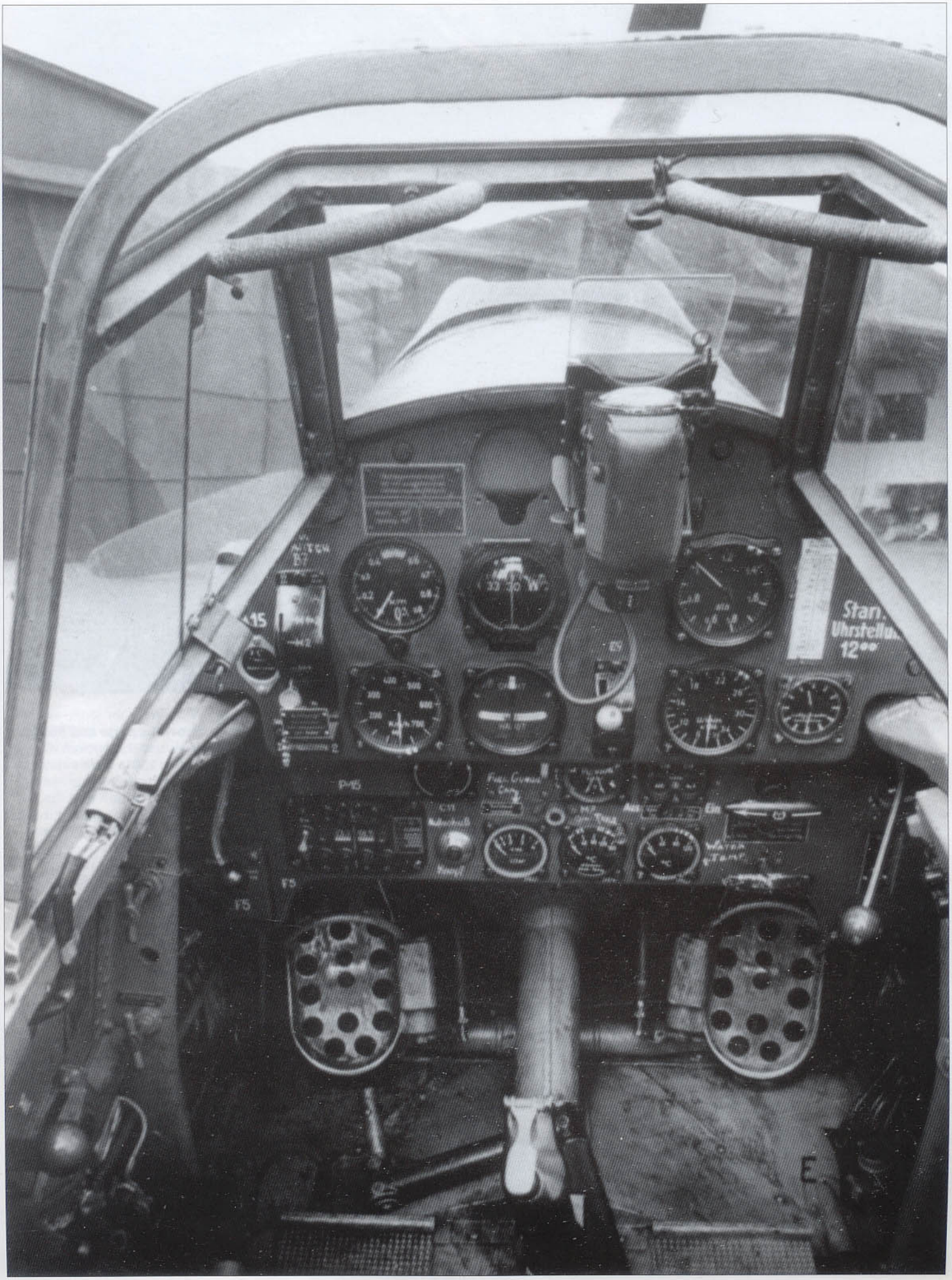


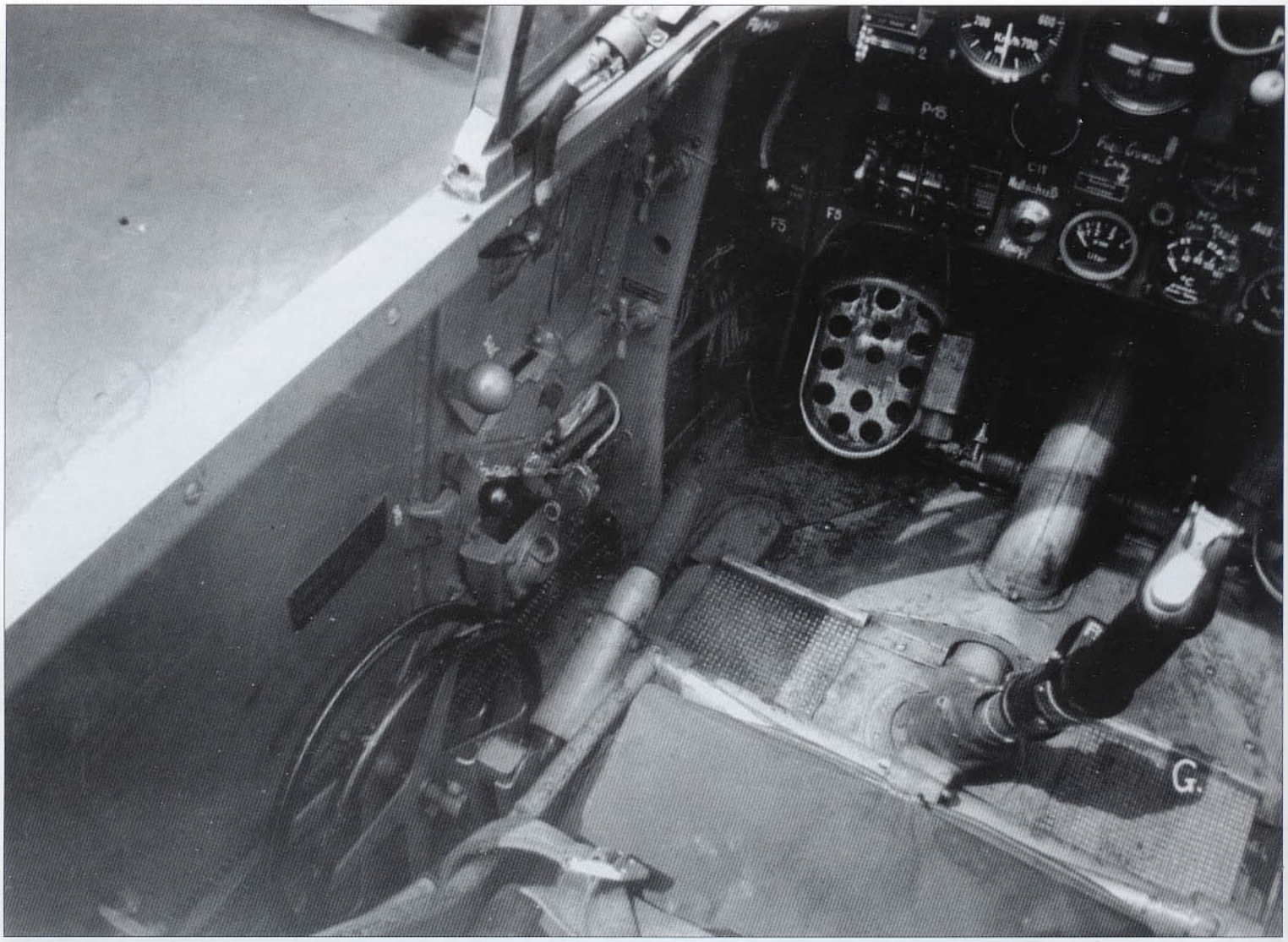




Bf 109 E-3 Cockpit

1. Oil cooler flap control
2. Throttle lever
3. Canopy lock
4. Ignition hand lever
5. Starter coupling hand lever
6. Instrument panel lamp
7. Fuel cock
8. Canopy ejection lever
9. Circuit breaker
10. Clear view window lock
11. Pitot head heating warning lamp
12. Ignition switch
13. Fuel contents gauge
14. Flap and landing speed data card
15. Oil temperature gauge
16. Fuel + oil pressure gauge
17. Dimmer rehostat
18. Airspeed indicator
19. Altimeter
20. Turn and bank indicator
21. Compass
22. Clock
23. Cockpit vetilation lever
24. Prop pitch control if not on throttle
25. Undercarriage position indicator
26. Coolant temperature gauge
27. Manifold pressure gauge
28. Tachometer
29. Undercarriage control lever
30. Deviation table placard
31. Emegency gear control lever
32. Prop pitch indicator
33. Fuel filter hand pump
34. Instrument panel light
35. Mech. gear position indicator
36. Main electrical circuit breaker panel
37. Signal flare pistol
38. Oxygen apparatus
39. Coolant radiator flap control
40. Fuel pump auto switch
41. Remote control ventilator
42. Map holder
43. Seat harness adjustment lever
44. Fuel primer pump
45. Hand lever for auto switch
46. Control column
47. Rudder pedals
48. Seat height adjustment
49. Tailplane incidence indicator
50. Flaps hand wheel control
51. Tailplane adjustment hand wheel
52. Trim indicator lamp
53. Low fuel warning lamp
54. Throttle friction adjuster
55. Engine instant-stop hand control


Start-
Uhrstellung
12°



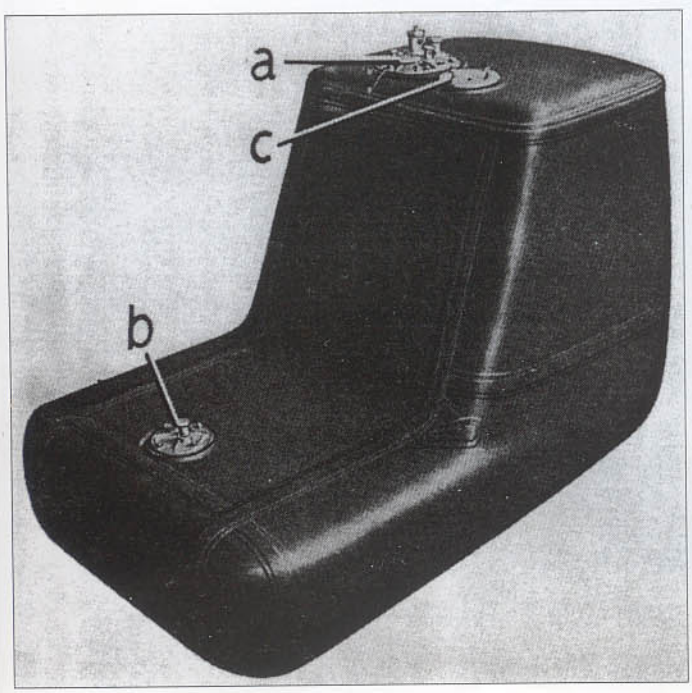
Previous page and above: Views of the cockpit of W.Nr. 1304. This aircraft was extensively tested in France, Britain and the United States before it was damaged beyond repair making a forced landing at Cambridge, Ohio, on November 3, 1942.

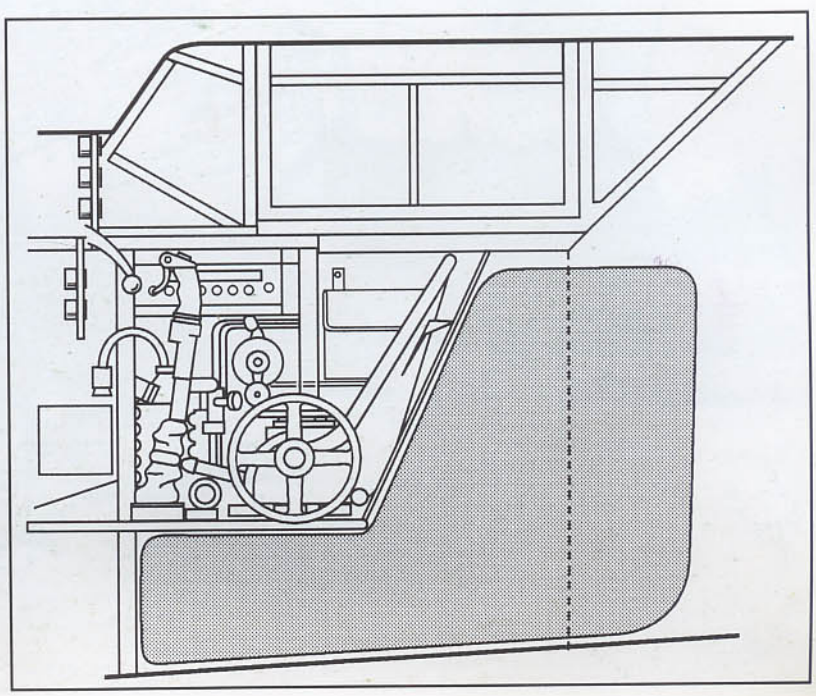
Left: A full-size replica of the basic Bf 109 E-3 instrument panel using original instruments and fittings.

Above: Another view of W.Nr. 1304's cockpit. Note this aircraft is fitted with perforated rudder pedals which replaced the older solid metal type. The rectangular metal plaque in the upper left hand corner contains instructions for flap settings and landing speeds.

Below left: A view of the flexible, non self-sealing fuel tank carried by the Bf 109 E-1 and E-3.

Below right: This drawing illustrates now the 105 gal (400 ltr) L-shaped fuel tank conformed to the contours of the Messerschmitt fighter.





Messerschmitt Bf 110 C-1

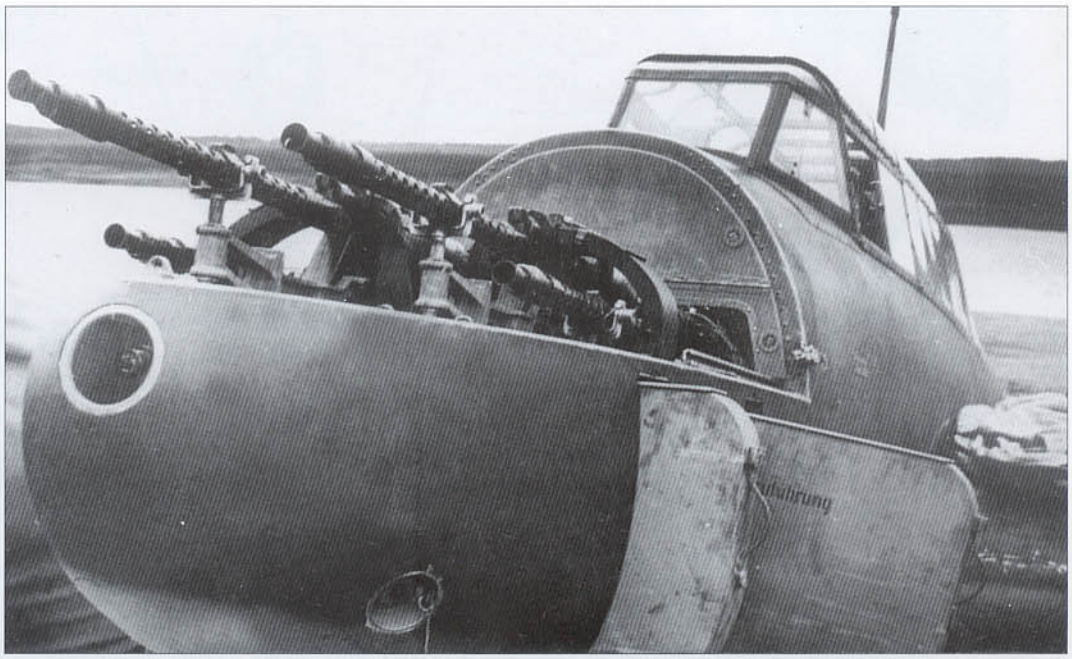
Production of the Bf 110 C-1 heavy day fighter of the *Zerstörer* class began in January 1939, powered by two Daimler-Benz DB 601 A engines driving metal, three-bladed VDM 9-11081A propellers. Fixed, forward-firing armament was comprised of four MG 17 machine guns (7.9 mm) with 1,000 rounds per gun in the upper portion of the nose, plus two MG FF cannon (20 mm) mounted in the lower section of the nose, with 180 rpg. The rear seat in the cabin had provision for one flexible-mounted MG 15 (7.9 mm) with 750 rounds. The C-1 series could also be fitted with two ETC 500 bomb racks under the fuselage, plus four ETC 50 racks mounted beneath the wings. Electrical equipment comprised the FuG III a U, the Peil GV FuBel and the Ei V4. A Revi C 12/D gunsight was mounted above the instrument panel.

The C-1 series first saw action over Poland, where its massive firepower had a devastating effect on enemy fighters. It also saw action over France and the Low Countries. However, in spite of early victories, the Bf 110 was becoming increasingly vulnerable to attack from a determined enemy.

Above and below: A newly built Bf 110 C-1, W.Nr. 3011, CF+NR, photographed prior to delivery to an operational unit.

Right: Close-up of the four MG 17 machine guns fitted to the nose of this Bf 110 C-1. Round opening in the nose is for the ESK 2000b gun camera.

Below: A general view of the nose of the Bf 110 C-series. Note the individual ammunition boxes which were loaded via external access panels and sat sideways beneath each weapon. The 16 mm ESK 2000b camera is shown in position. The sighting telescope, used for accurate alignment and gun harmonization, is mounted on its upper surface. This camera magazine held almost 50 ft (15 m) of film giving 2,000 frames.



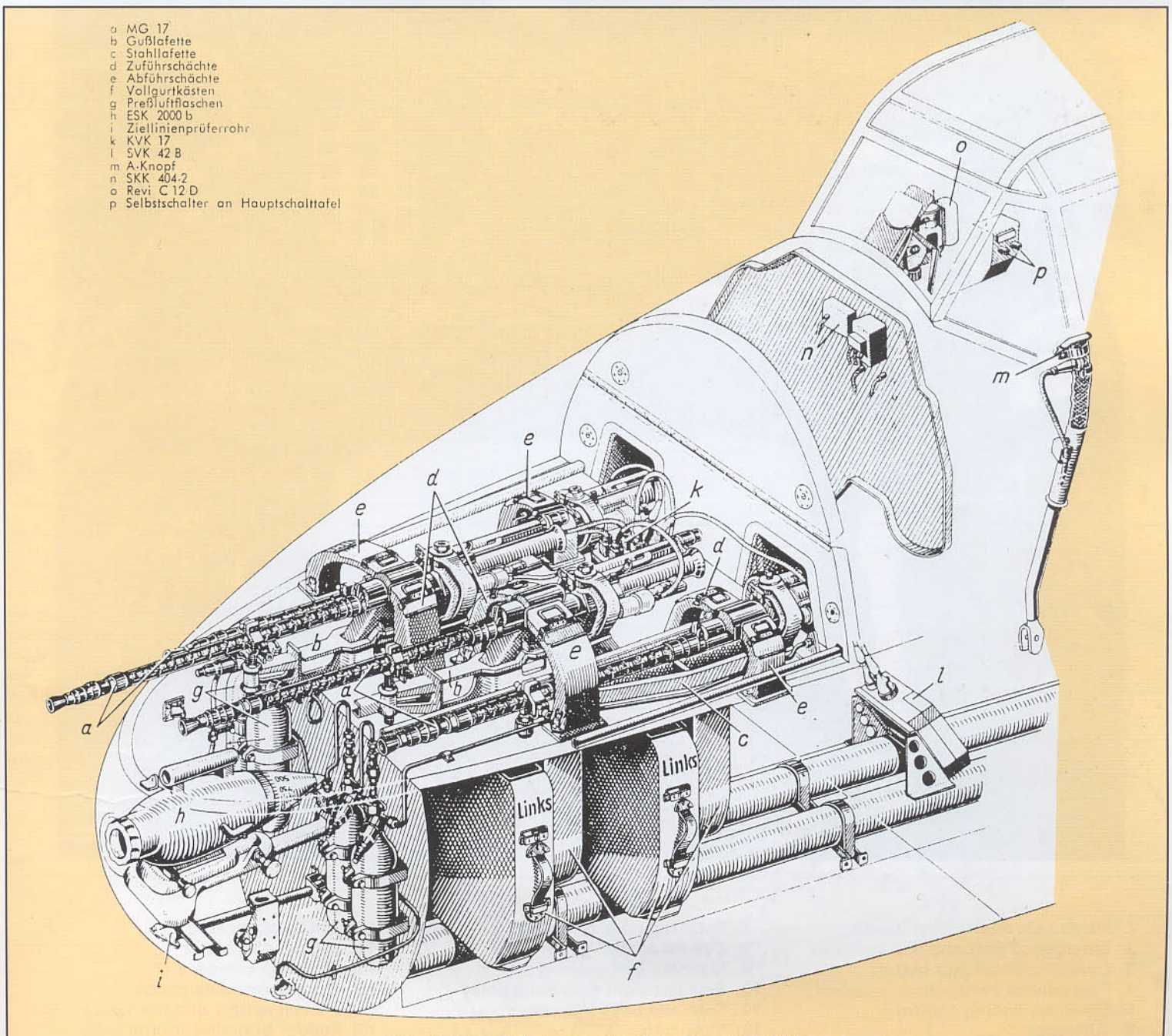
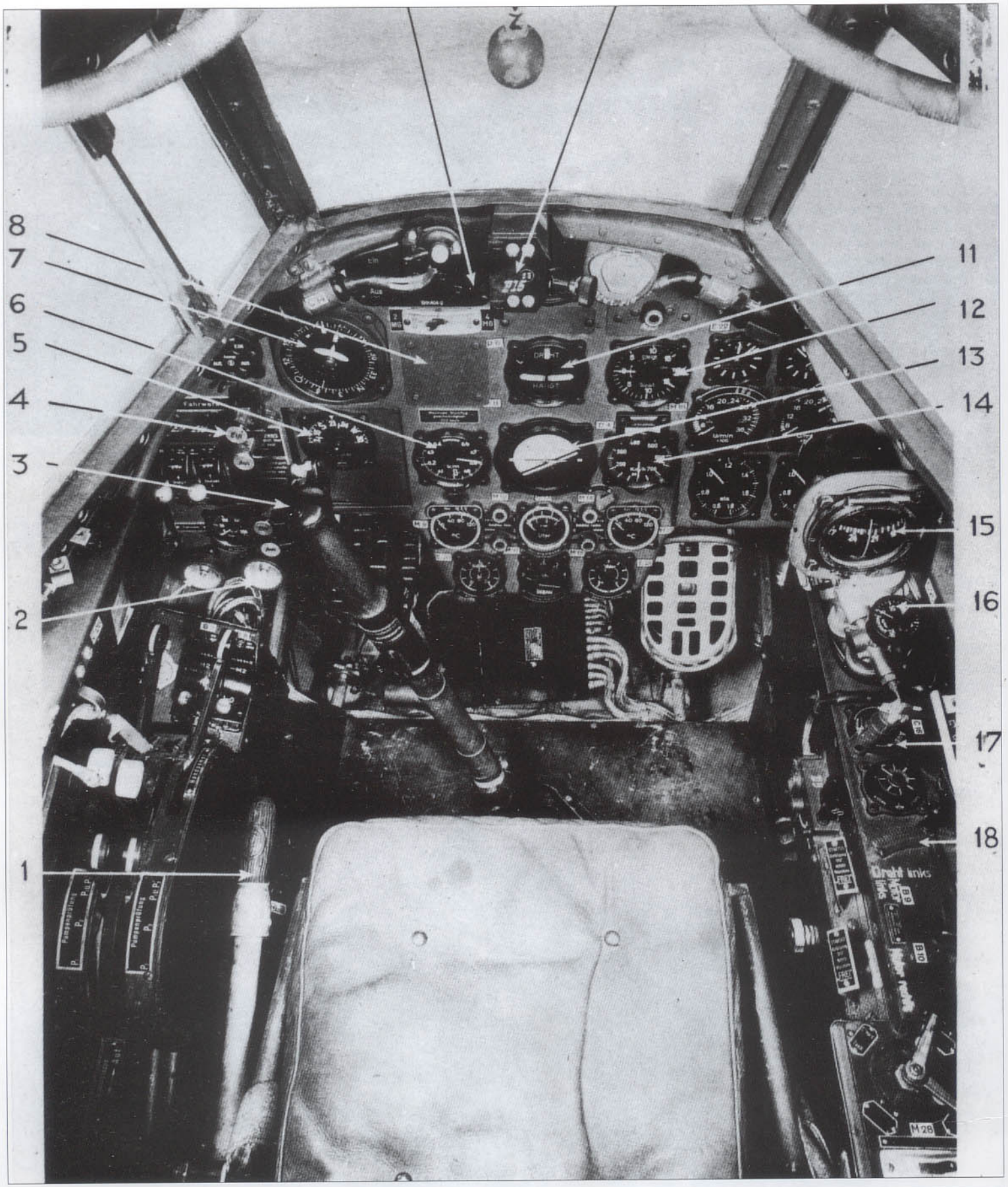


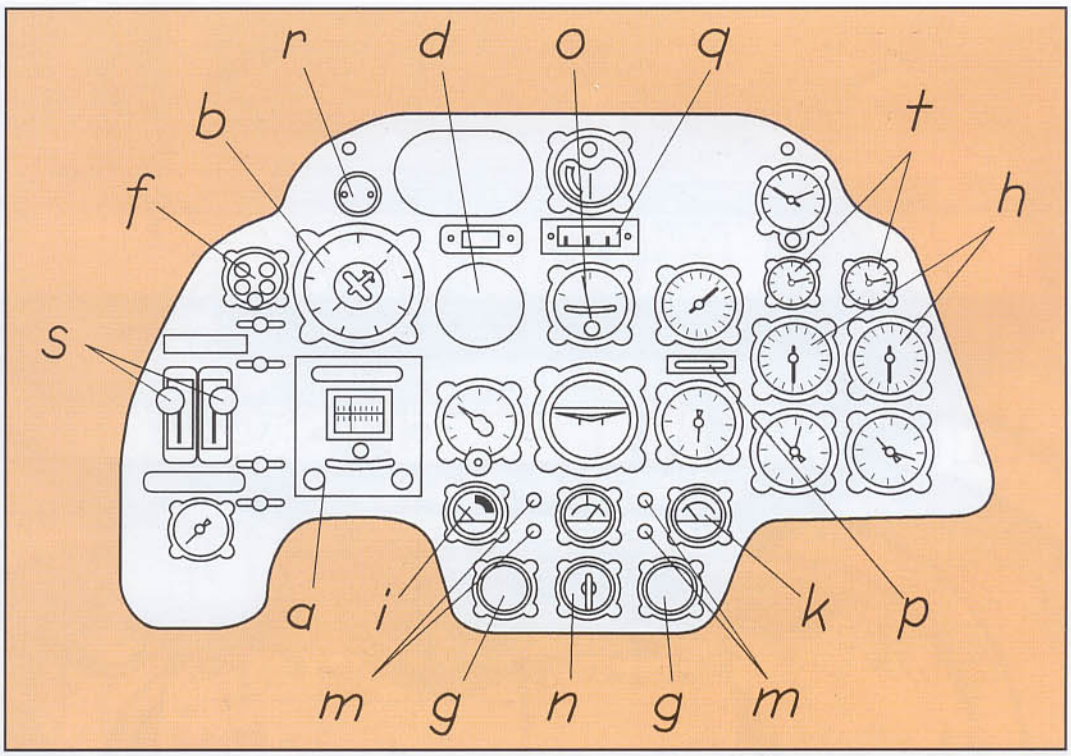
Abb. 41: Übersicht der Schußwaffenanlage 4 MG 17

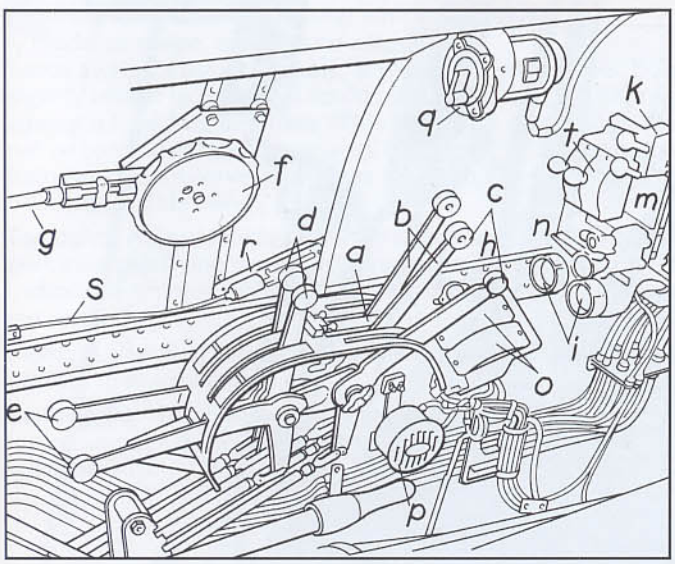


Bf 110 C-1 Cockpit

1. Pilot's seat adjustment handle
2. Emergency gear and flap switches
3. Control column gun button
4. Flap control switches
5. Direction finding control
6. Altimeter
7. Patin repeater compass
8. ZVK-FF control when fitted
9. Machine gun cocking switch
10. Revi gunsight mounting point
11. Turn and bank indicator
12. Variometer
13. Aritificial horizon
14. Airspeed indicator
15. Magnetic compass
16. Oxygen pressure gauge
17. Cockpit lamp + dimmer switch
18. Rudder trimming control lever

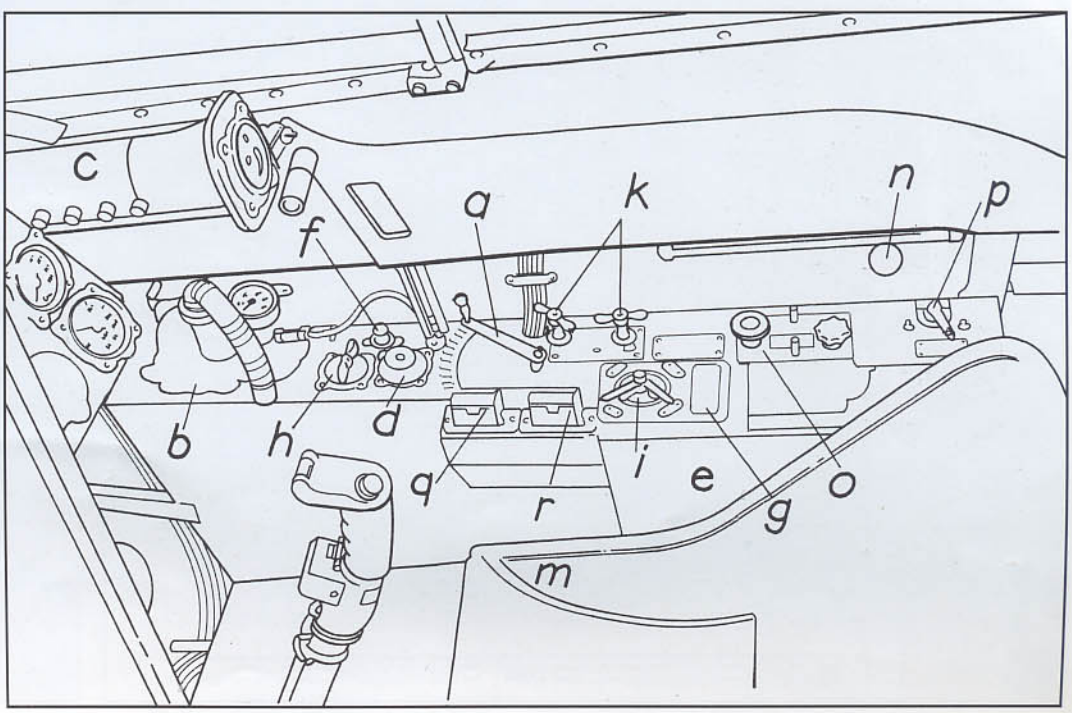
Right: Instrument panel for the Bf 110 C-1. Item (a) gyro compass, (b) Patin repeater compass, (c)_, (d) control unit for ZVK-FF (when fitted), (e) _, (f) undercarriage indicator lights, (g) radiator flap position indicator, (h) tachometers, (i) port engine coolant temperature gauge, (k) starboard engine coolant temperature gauge, (m) low fuel warning lights, (n) change over switch for fuel gauge, (o) slip indicator, (p) pitot heating indicator lamp, (q) course indicator, (r) auto pilot emergency cut-out, (s) propeller pitch change levers, (t) propeller pitch indicators.

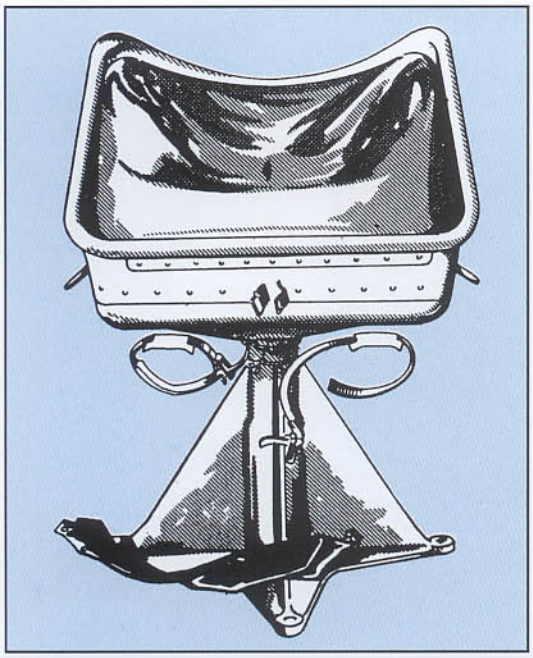


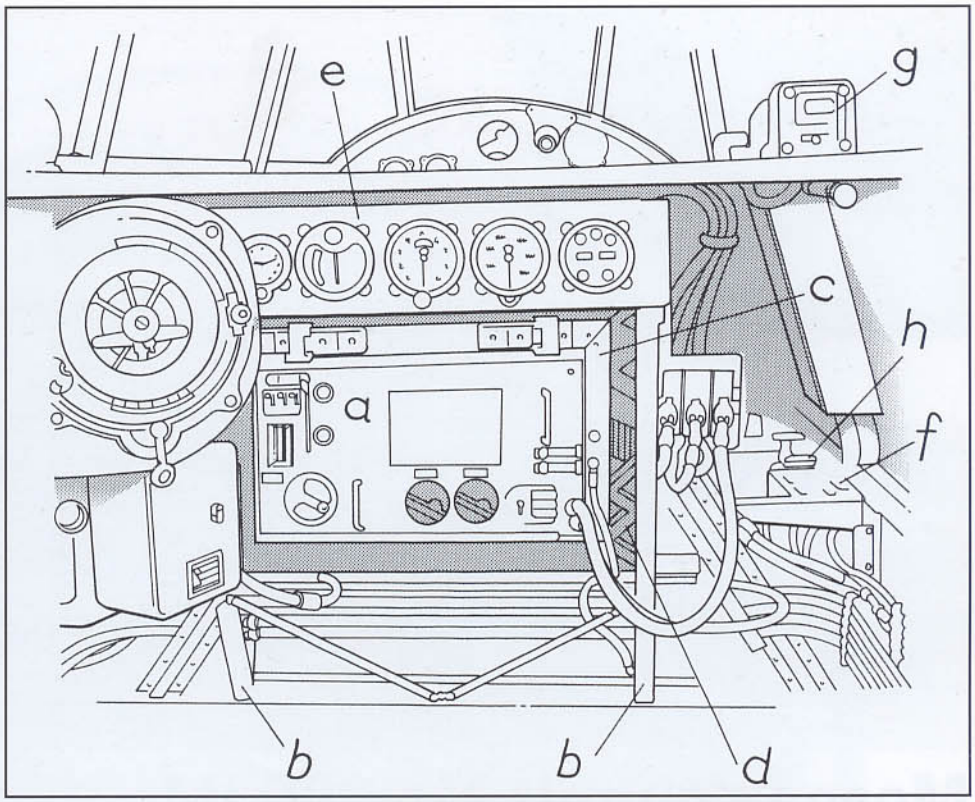


Left: Left side of the Bf 110 C-1's cockpit showing (a) throttle quadant, (b) throttle levers, (c) fuel pump priming levers, (d) fusel shut off levers, (e) oil cooler flap levers, (f) elevator trim wheel, (g) cockpit wall, (h) master electrical cut out buttons for engines, (i) emergency control valves for port and starboard undercarriage, (k) undercarriage indicator lights, (m) flap switches, (n) compressed air selector for emergency lowering of undercarriage, (o) magneto switches, (p) undercarriage warning light, (q) auto pilot correction switch, (r) mechanical landing flap indicator, (s) Bowden cable, (t) propeller pitch change levers.

Right: Right side of the Bf 110 C-1's cockpit showing (a) rudder trim handle, (b) oxygen equipment, (c) magnetic compass, (d) dimmer switch, (e) auxiliary console, (f) landing light switch, (g) fuel pump booster, (h) rotary switch, (i) fuel selector lever for fuel pump, (k) spark plug cleaning handles, (m) oxygen control valve, (n) unknown, (o) fuel pump priming unit, (p) fuel tank pump switches, (r) engine starter handle starboard.





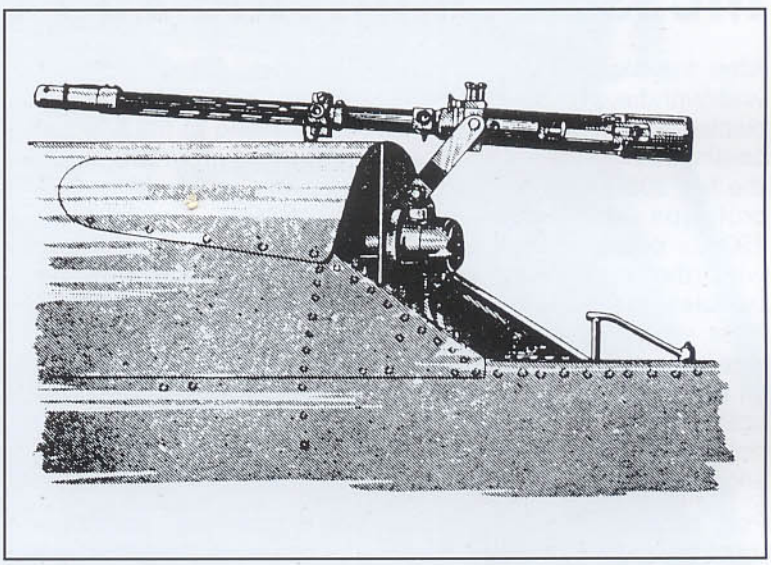


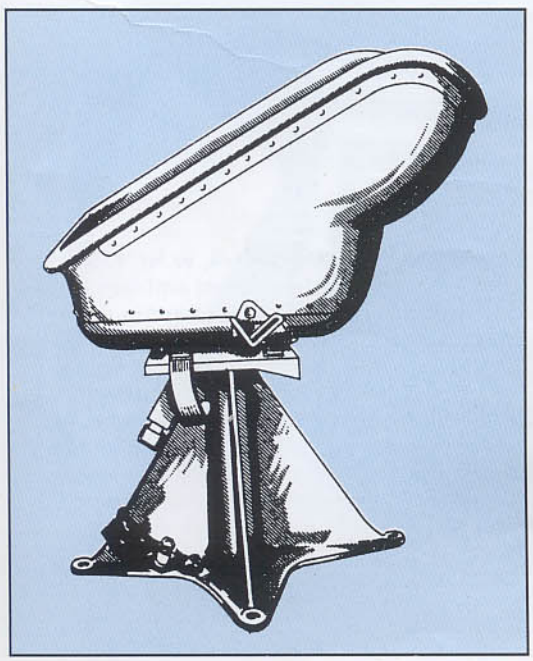
Left opposite: Inside the cockpit of a Bf 110 C-1 looking aft, over the back of the pilot's seat. Shown in the lower center is the gunner's seat (also shown above and below) with its carefully modeled shape, bulged and angled rearwards along its upper section. It was anchored by four bolts, slightly off-set to port, and could rotate through 360 degrees against a light friction brake. This elaborate seat design would not be continued in later variants of the Bf 110. A radio operator/navigator (observer) seat was fitted on the wing main beam truss (not visible here).

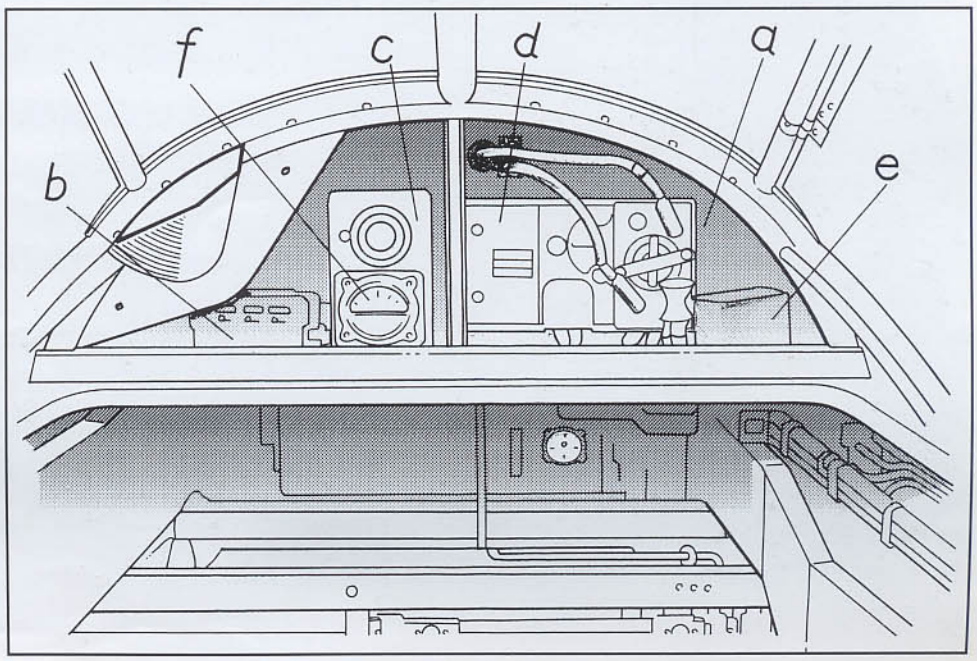
Top right: A view looking forward immediately behind the pilot's seat showing the Patin repeater compass, clock, AFN-2 indicator, altimeter, airspeed indicator and the turn and bank indicator.

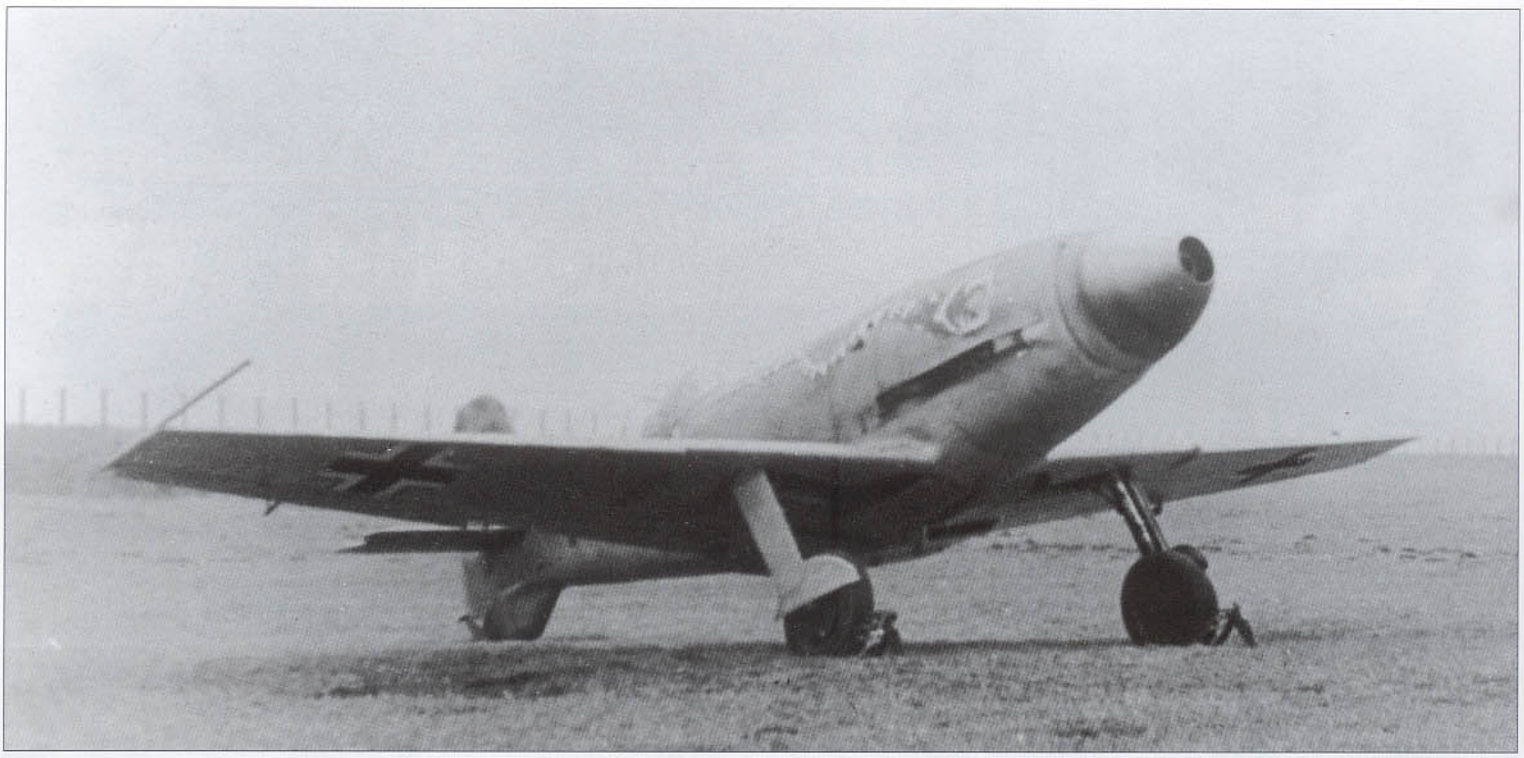
Right: A sketch of the rear gunner's position showing the flexible MG 15 machine gun.

Below right: The rear gunner's position looking aft. The scalloped cut-out area to the left was for stowage of the MG15 machine gun.







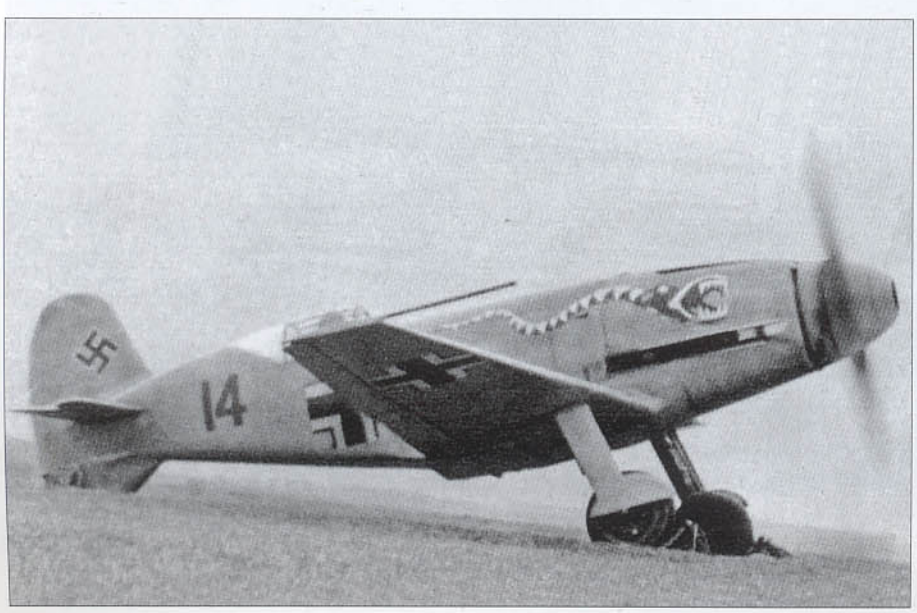


Messerschmitt Me 209 V4

After the Me 209 V1 had broken the world speed record, it was withdrawn from further use and set aside for museum display when the war was over. Flight testing of the Me 209 continued with the V3 and the first genuine fighter prototype, the Me 209 V4, W.Nr. 1188, D-IRND, later as CE+BW. This prototype was first flown during the afternoon of May 12, 1939, powered by a DB 601 A. It was initially equipped with the complex surface-evaporation cooling system. This troublesome system was eliminated after the eighth test flight, when two conventional shallow-depth underwing radiators were installed. The fourth prototype was also fitted with an entirely new wing, shortened landing gear and revised vertical tailplane. It was also to have been fitted with two 7.9 mm MG 17 machine guns over the cowl and a 20 mm, engine-mounted MG FF cannon.

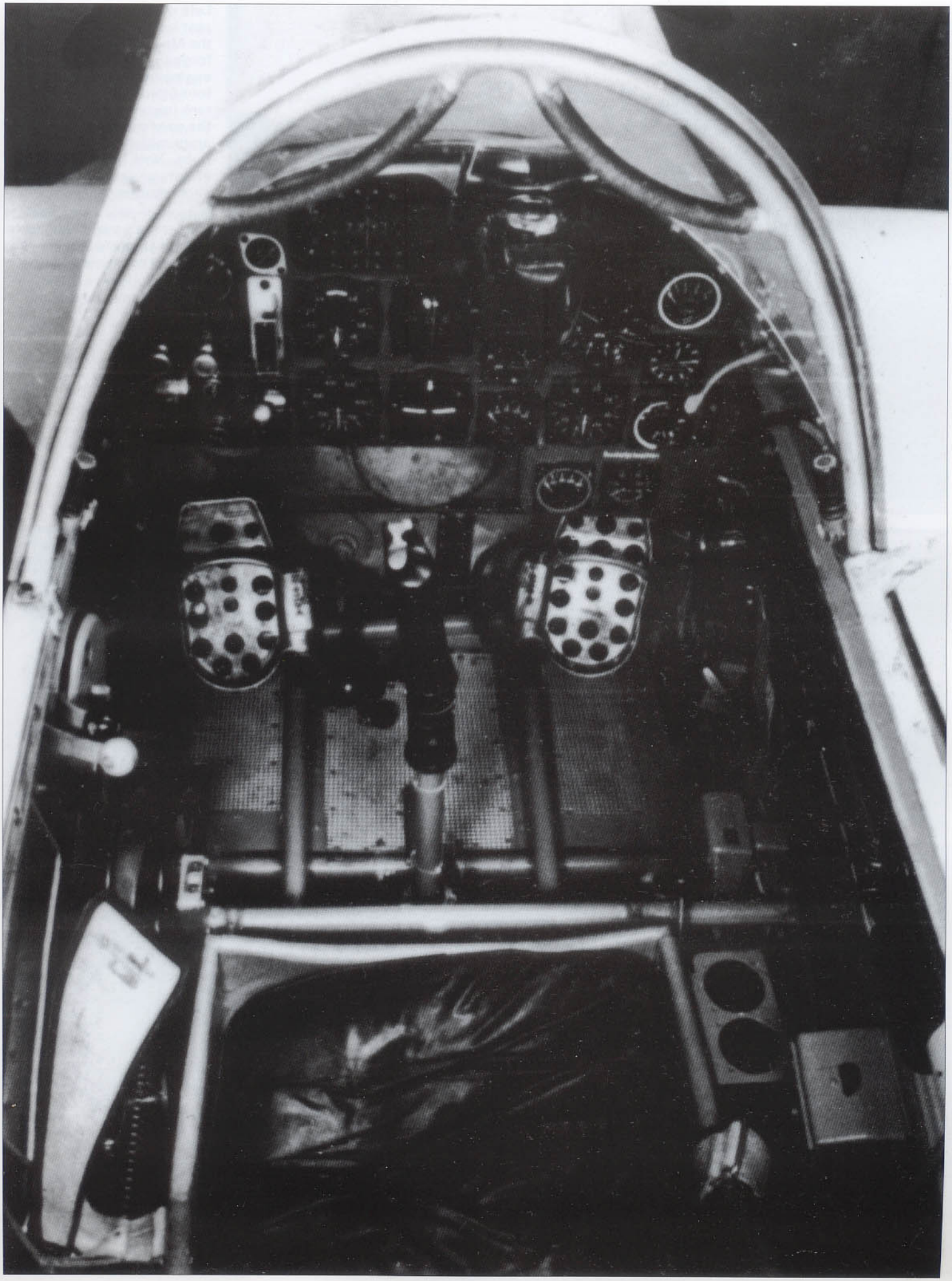
Poor handling and flight characteristics continued to plague the Me 209. No fewer than five additional wing designs were investigated, in addition to certain modifications to the vertical tailplane. The original DB 601 A was exchanged during the summer of 1940 for a new, more powerful DB 601N (see p. 86), in an effort to improve the aircraft's disappointing performance. However, development of the Me 209 continued up to January 22, 1941, when all further testing was terminated after it was finally recognized that the design would never surpass newer models of the Bf 109 E and F-series then in production.

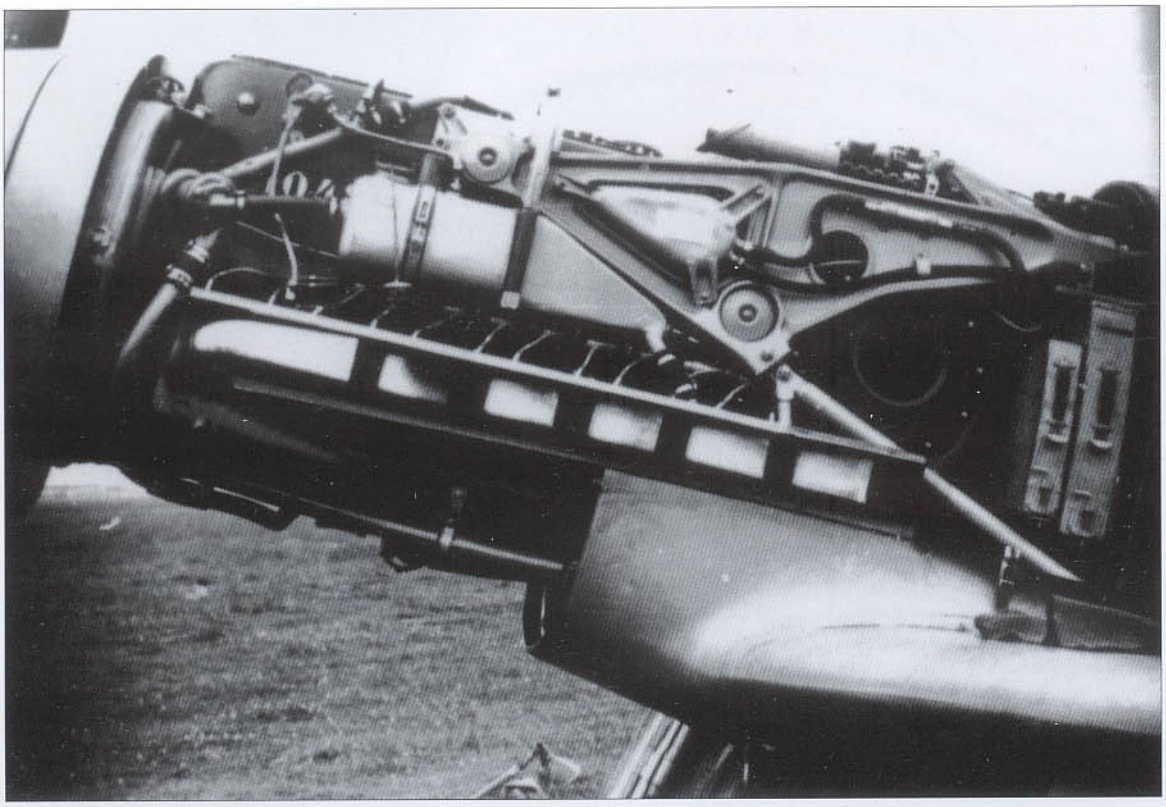
In giving Messerschmitt authorization to build the Me 209 as a record breaker, the RLM also stipulated that the aircraft be developed as a fighter. Plans were drawn up and a wooden mock-up of the fighter version was built. It closely resembled first prototypes, apart from its all-round vision canopy. Armament was to be comprised of two machine guns (presumably MG 17s) installed under the cowling plus an engine-mounted cannon (probably the 20 mm MG FF).



Above and left: The Me 209 V4, W.Nr. 1188, adorned with a spurious serpent emblem and an equally fictitious number, 14, being run-up for the benefit of propaganda suggesting to the unknowing that this "new German fighter" was in operational service with the *Luftwaffe*. In truth, the fourth prototype was intended to serve as a development vehicle for the planned Me 209 fighter, but in spite of considerable testing, it was finally recognized that the design was flawed and not worth further development.

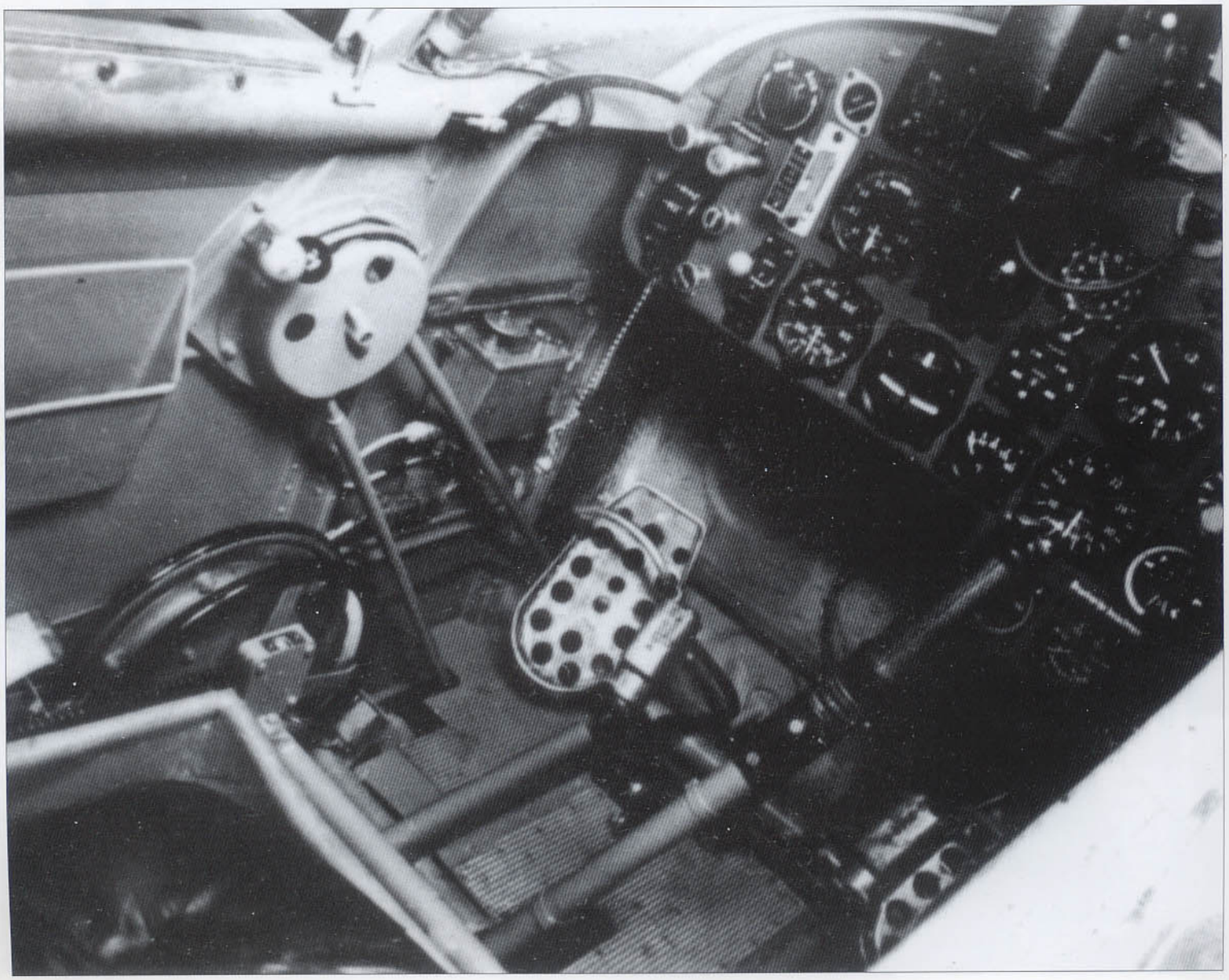
Right opposite: A view inside the cockpit of the Me 209 V4. It is interesting to see the similarities between this aircraft and the Bf 109 E-3's cockpit shown on page 63.



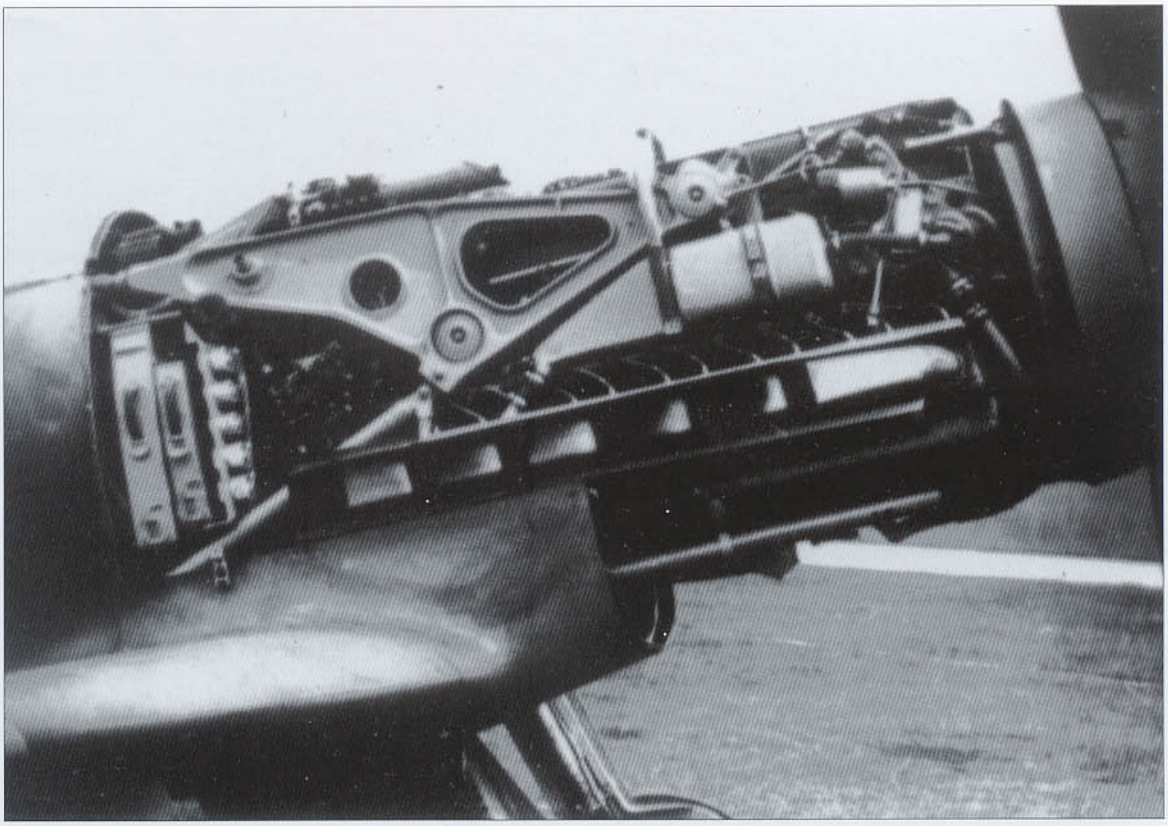


Left: An overall view of the port side of the DB 601 A of the Me 209 V4 showing the forged Elektron magnesium engine bearer arm, the contour-fitted coolant header tank immediately below and the cowl machine guns ammunition boxes to the far right. Note the engine bearer arm covers most of the supercharger.

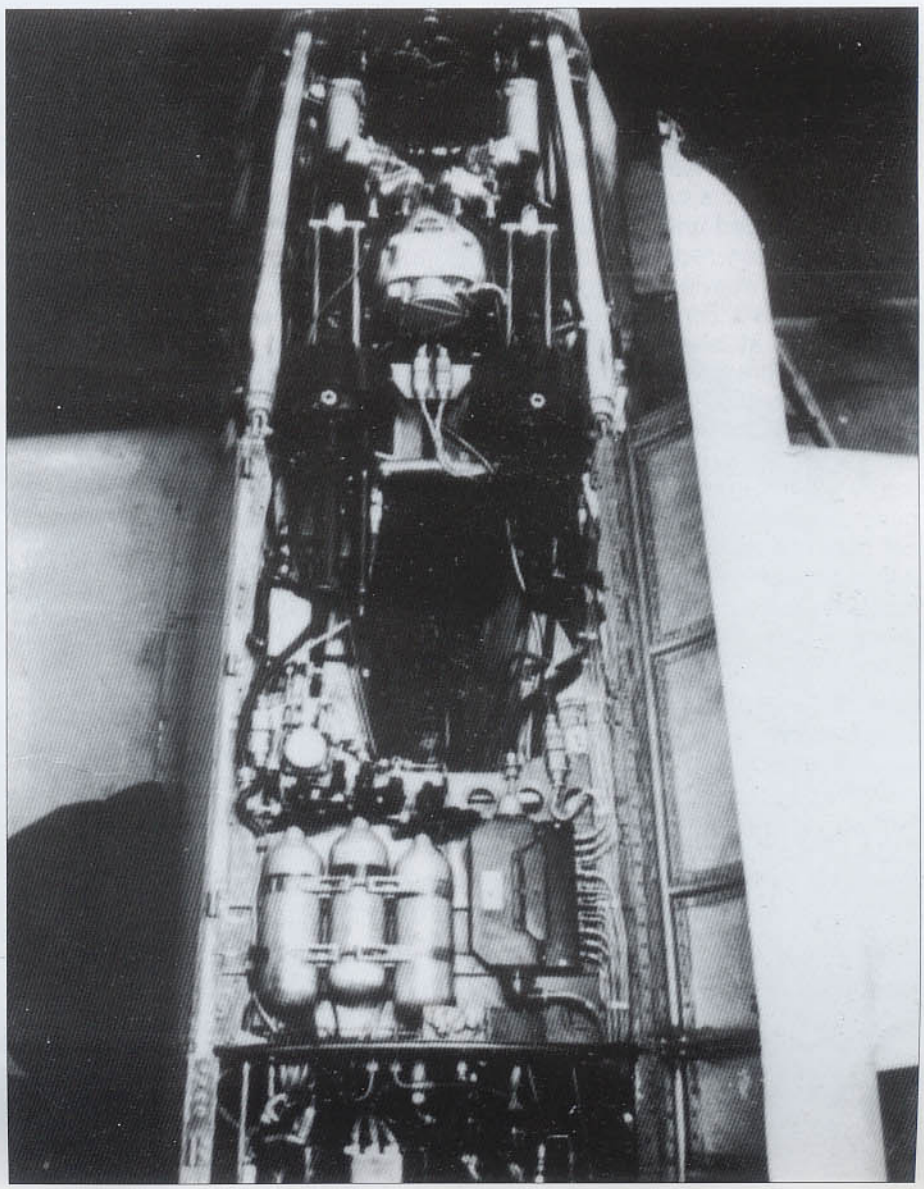
Below: A view of the left side of the cockpit containing the engine throttle and tailplane trim wheel. Note that the rudder pedals have been lightened by drilling-holes.



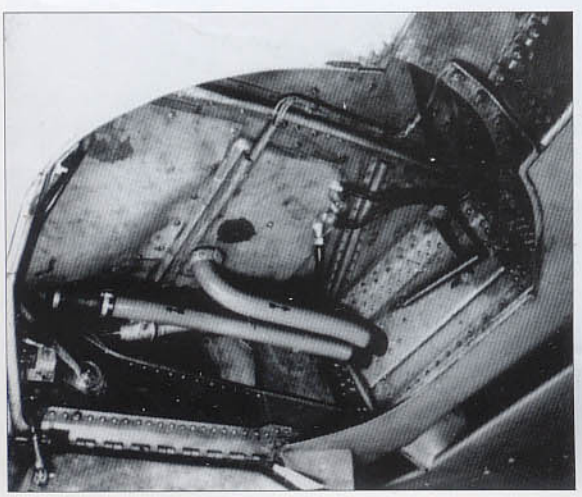
Right: A general view of the starboard side of the Me 209 V4's engine with top and bottom cowling removed. The engine was mounted to the engine bearer arms at two points on each side which were fitted with rubber anti-vibration pads. This simple, yet effective, method of mounting the engine greatly facilitated rapid replacement of the engine which could be accomplished in less than one-half hour by experienced mechanics.

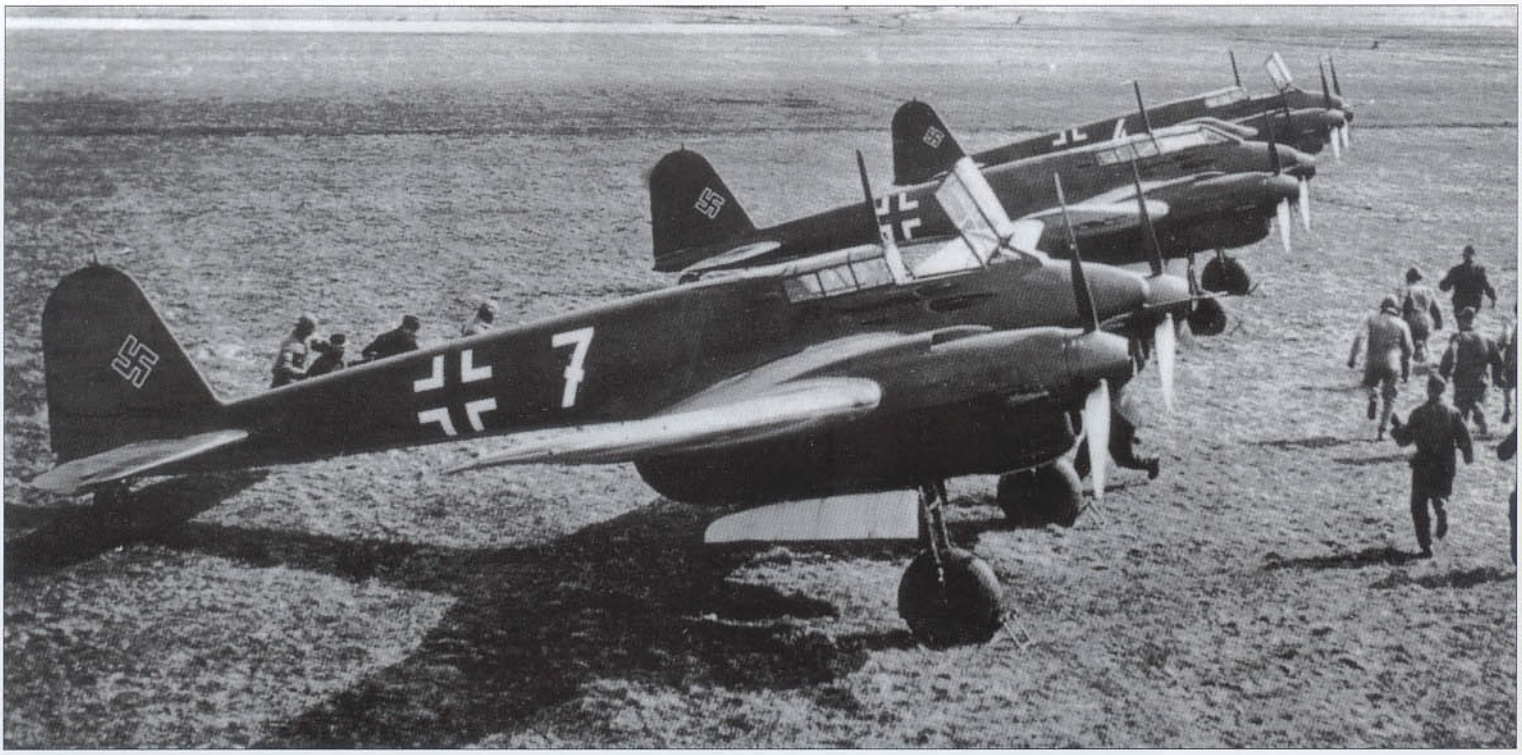


Right: A top view of the engine bay looking forward from the firewall showing the twin supports for the cowl-mounted MG 17 machine guns (not yet installed), three oxygen tanks and various electrical components. Large cavity in the center was the access area for the engine-mounted MG FF cannon. Messerschmitt experienced considerable difficulty in adapting this 20 mm weapon to the engine-mounted position. Since this normally effective and reliable weapon was basically designed for use in other positions within the airframe, it never lived up to expectations when mounted to the engine with its high temperatures and poor cooling.



Below: Close-up view of the Me 209 V4's left wheel well shows a clear departure from Bf 109. Instead of leather or canvas as a sealing material, the Me 209 was metal throughout. Wheel well doors were also a departure from previous Messerschmitt practice with the older Bf 109.





Focke-Wulf Fw 187 A-0

Initially conceived in 1935 as a single-seat day fighter, the Fw 187 was virtually a private venture by Focke-Wulf under the leadership of the firm's Technical Director, Dipl. Ing. Kurt Tank. Several prototypes were built (Fw 187 V1 to the Fw 187 V6) and flown without much official interest being shown in the project. However, by 1937, in spite of the fact that the Fw 187 was still a type without a mission, authorization was given to proceed with additional aircraft which, in the meantime, had been redesigned to incorporate a second crew member and heavier armament. In this configuration, it was reclassified as a *Zerstörer,* a heavily armed, twin-engined, day fighter with at least two crew members. Three of these machines were manufactured in the summer of 1939, a short while before the outbreak of war in Europe. Designated as Fw 187 A-0 pre-production aircraft, the three aircraft were each powered by two Jumo 210 Ga engines and armed with a forward-firing armament of four MG 17 (7.9 mm) machine guns on either side of the cockpit, plus two MG FF (20 mm) cannon mounted on either side of the lower fuselage. Although never fitted to these three aircraft, Kurt Tank made provision for two fixed, rear-firing machine guns about midway along the lower rear fuselage, in a lame attempt to satisfy one of the provisions of the *Zerstörer* specification.

Kurt Tank was still hopeful the Air Ministry (RLM) would award a production contract for the Fw 187 at the time the three Fw 187 A-0s were flown to Rechlin for evaluation. However, inasmuch as the Bf 110, then in service with the Luftwaffe, was fulfilling the *Zerstörer* role with ease, the RLM declined to sanction production of another aircraft to meet the same mission. As a consequence, the three Fw 187 A-0s were returned to Focke-Wulf at Bremen.

Interestingly, in spite of the fact that the RLM showed little interest in the Fw 187, Kurt Tank continued design studies around different power plants, and at least one additional prototype, the Fw 187 V7, had been planned using an unspecified new engine. Two additional design studies were advanced, one powered by two Daimler-Benz DB 605s and the other with two BMW 801s.

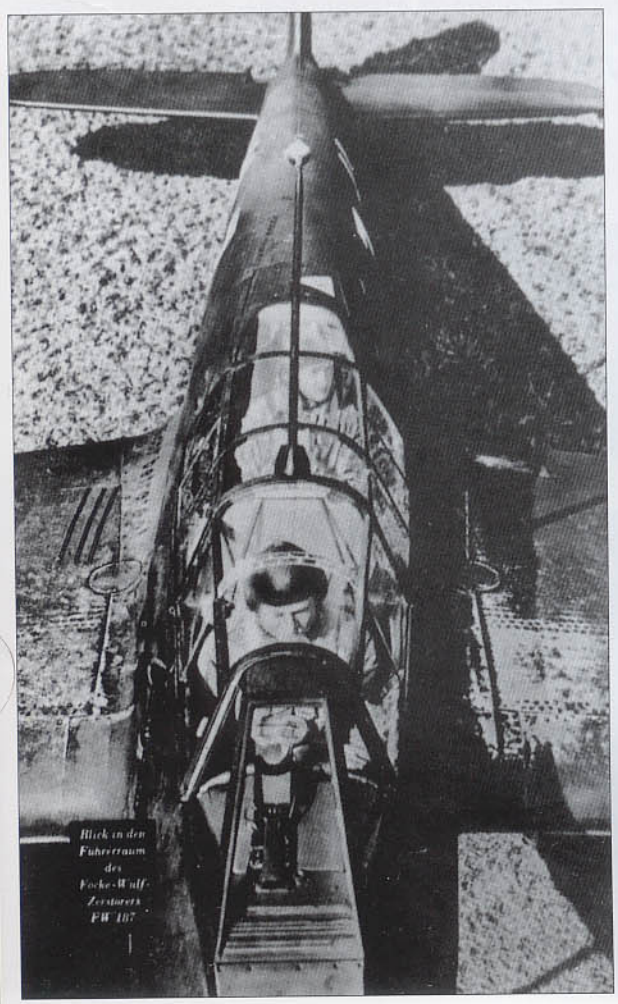
After the three Fw 187 A-0s had been returned to Bremen early in 1940, they were assigned the special task of protecting the main Focke-Wulf plant from enemy bomber attack. Flown by company test pilots and maintained by the factory, the three aircraft continued flying in this capacity until early 1941, when they were transferred to Norway for service evaluation. It has been reported that one of the Focke-Wulf test pilots, Dipl-Ing. Mehlhorn, scored no less than three victories while flying one of the Fw 187 A-0s. One aircraft subsequently was based in Denmark for a short period, but eventually all three were once again returned to Bremen, where they carried out various equipment tests.

In spite of the fact that fewer than a dozen Fw 187s had been built, the German Ministry of Propaganda issued a number of photographs during the summer of 1940 (shown on this page and opposite) purporting to show the Fw 187 in widespread service with the *Luftwaffe*. The ruse worked. Countless recognition models and posters were circulated by the Allies describing the new German warplane "now entering service" with the German Air Force.

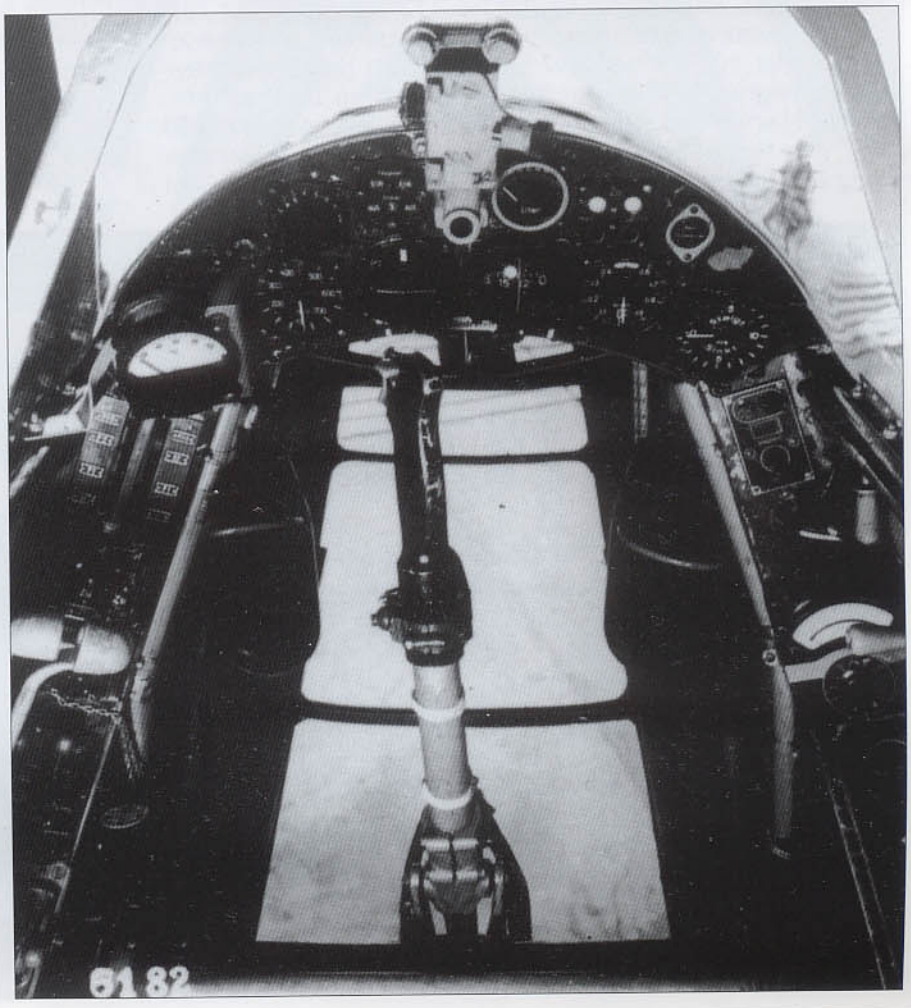
Above: A well known 1940 propaganda photograph showing pilots running to their aircraft. In truth, these three Fw 187 A-0s may have actually seen action when they were later assigned to a special factory protection flight based at Focke-Wulf's Bremen facility.

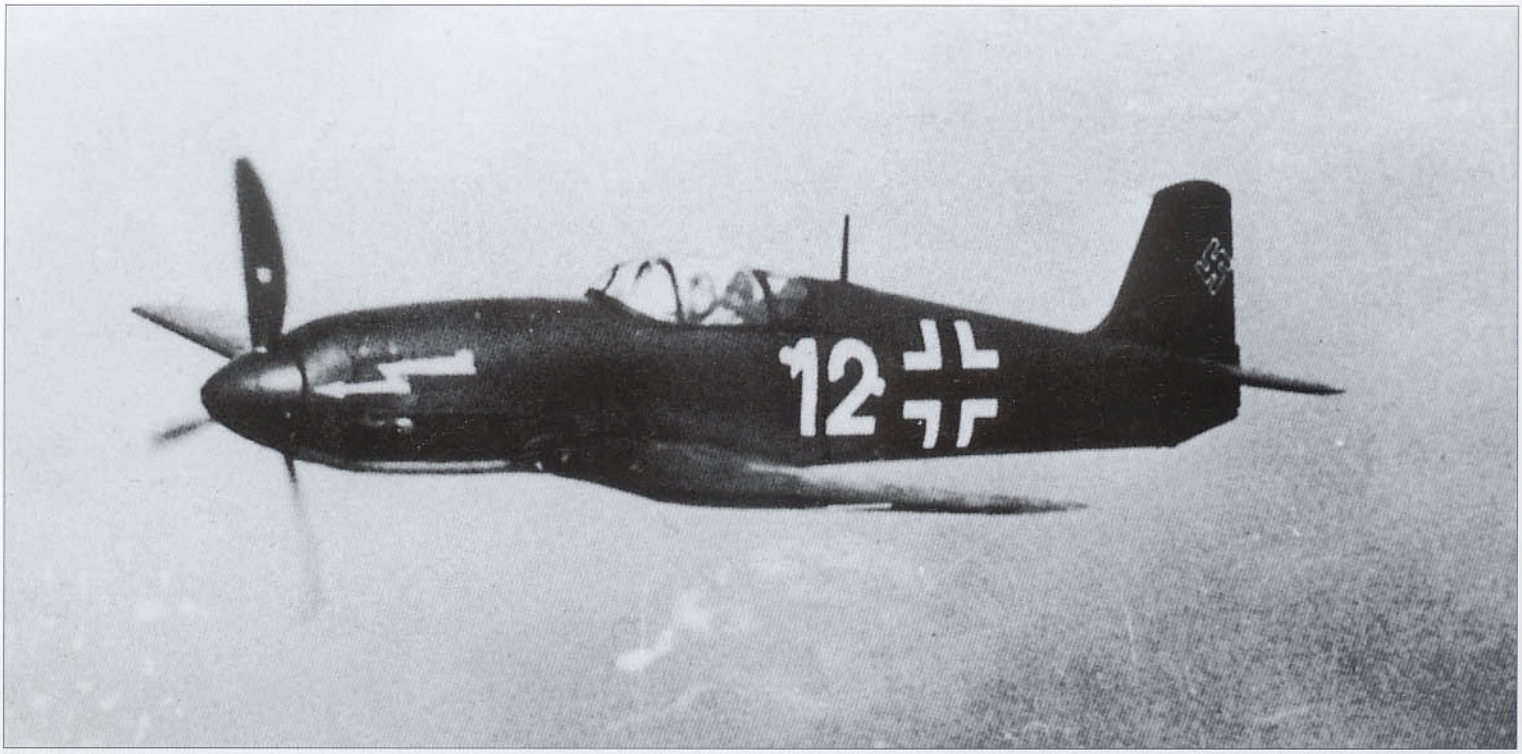
Opposite top: A good view of the nose and cockpit area of the Fw 187 A-0 showing the armored windscreen and semi-enclosed machine guns.

Opposite right: The radio operator sat in an aft-facing position immediately behind the pilot. **Opposite far right:** This view of one of the early Fw 187 prototypes, shows the clear vision windscreen, instrument panel layout and the lower nose window arrangement.



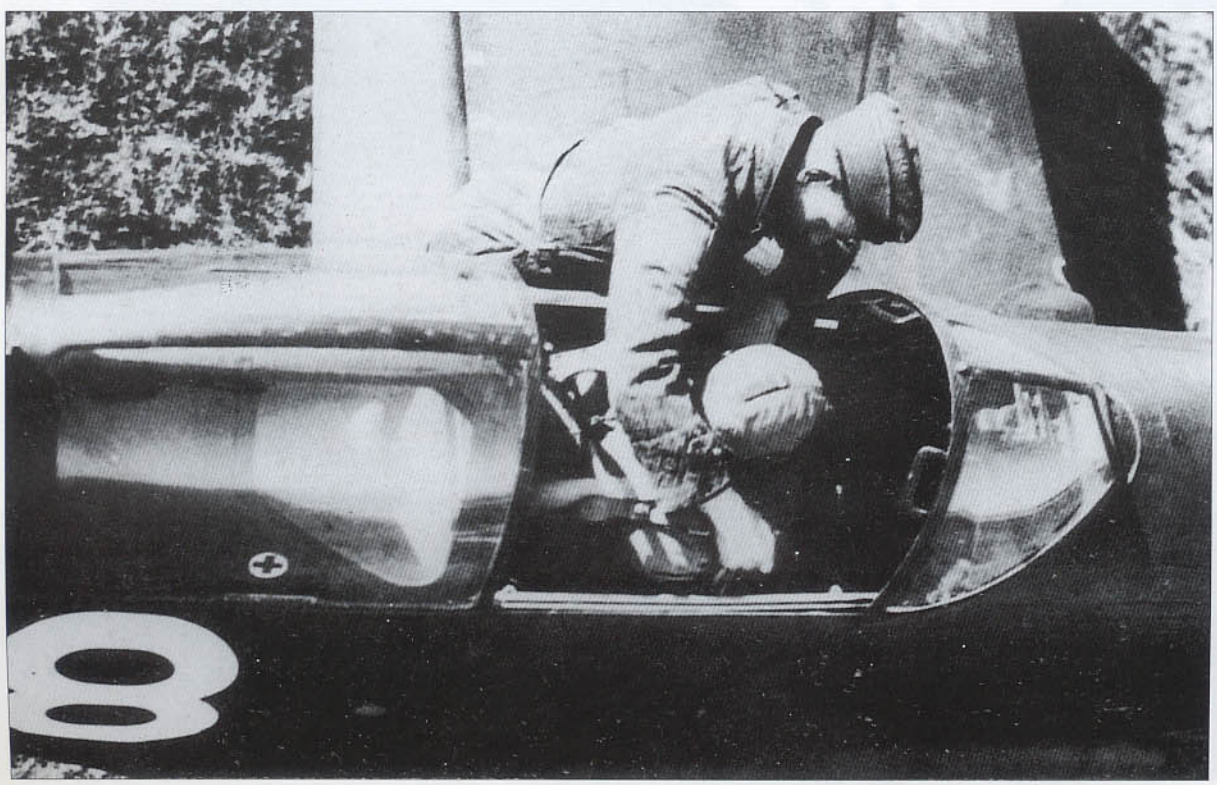
Blick in den Führerraum des Focke-Wulf-Zerstorers FW 187





Heinkel He 100 D-1

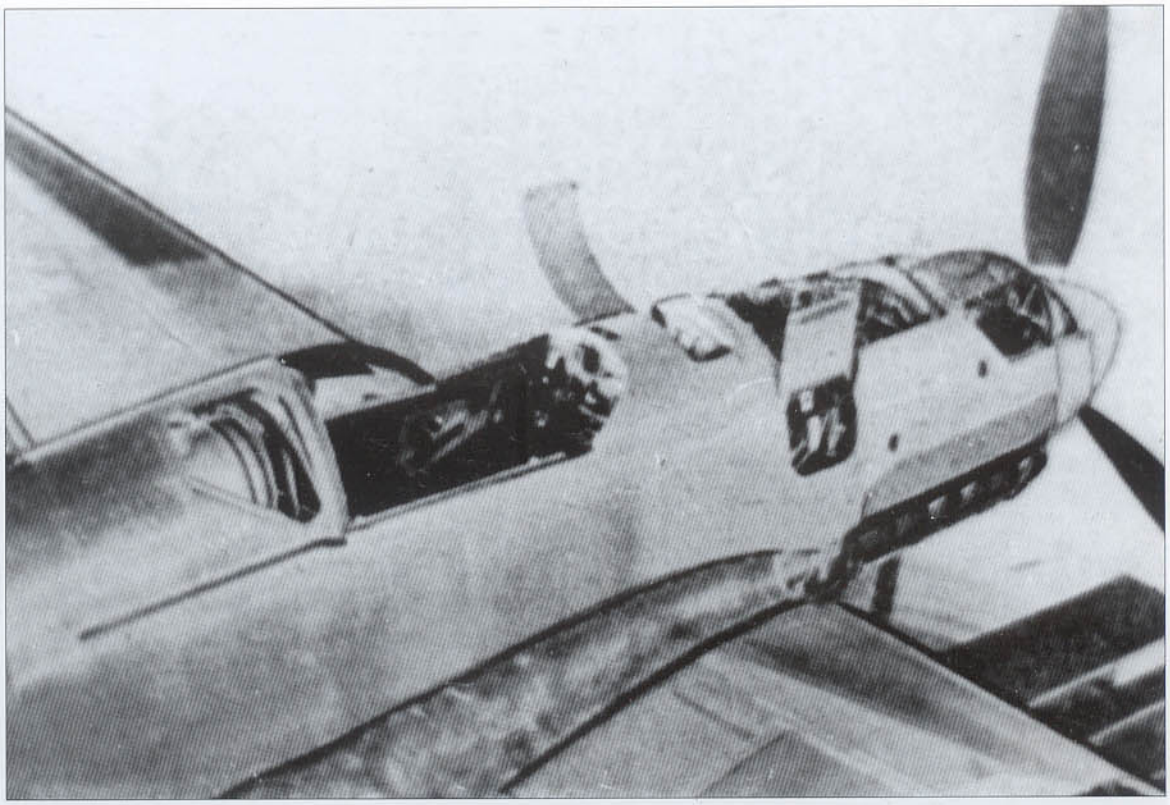
If in the spring of 1940 you had believed the German Propaganda Ministry, the sleek Heinkel He 100 was not only in full production, but also in active service with the *Luftwaffe*. In addition to this misconception, the fighter's type number was also masked. The RLM GL/C aircraft type number 113 had earlier been issued to Heinkel and, for a brief time, it was known as the He 113. However, for reasons of personal preference, Heinkel requested adoption of the number 100 for his new fighter, which had been previously assigned to Fieseler but not taken up by that firm. Initially, Heinkel had built the He 100 as a successor to the Bf 109. His fighter was largely built around the new Daimler-Benz DB 601 engine, but with a highly innovative form of cooling known as surface evaporation. Inasmuch as the DB 601 was already powering production versions of the Bf 109 (the E-series), the Air Ministry was loath to sanction production of another single-seat fighter powered by the same engine. As a consequence, the three He 100 D-0 pre-production aircraft, and the twelve D-1 production machines were offered first on the export market. Following delivery of the three D-0s to Japan and three D-1s to the Soviet Union, the remaining nine D-1s were employed by the Propaganda Ministry.



Above: This in-flight view of a He 100 D-1 clearly shows the clean lines of the fighter. The lightening flash painted on the cowling is a fictitious unit emblem which was part of the German propaganda effort to give the impression the type was in active service. The number "12" may indicate that this was the twelfth production aircraft. A total of twelve He 100 D-1s were built between 1939 and 1940.

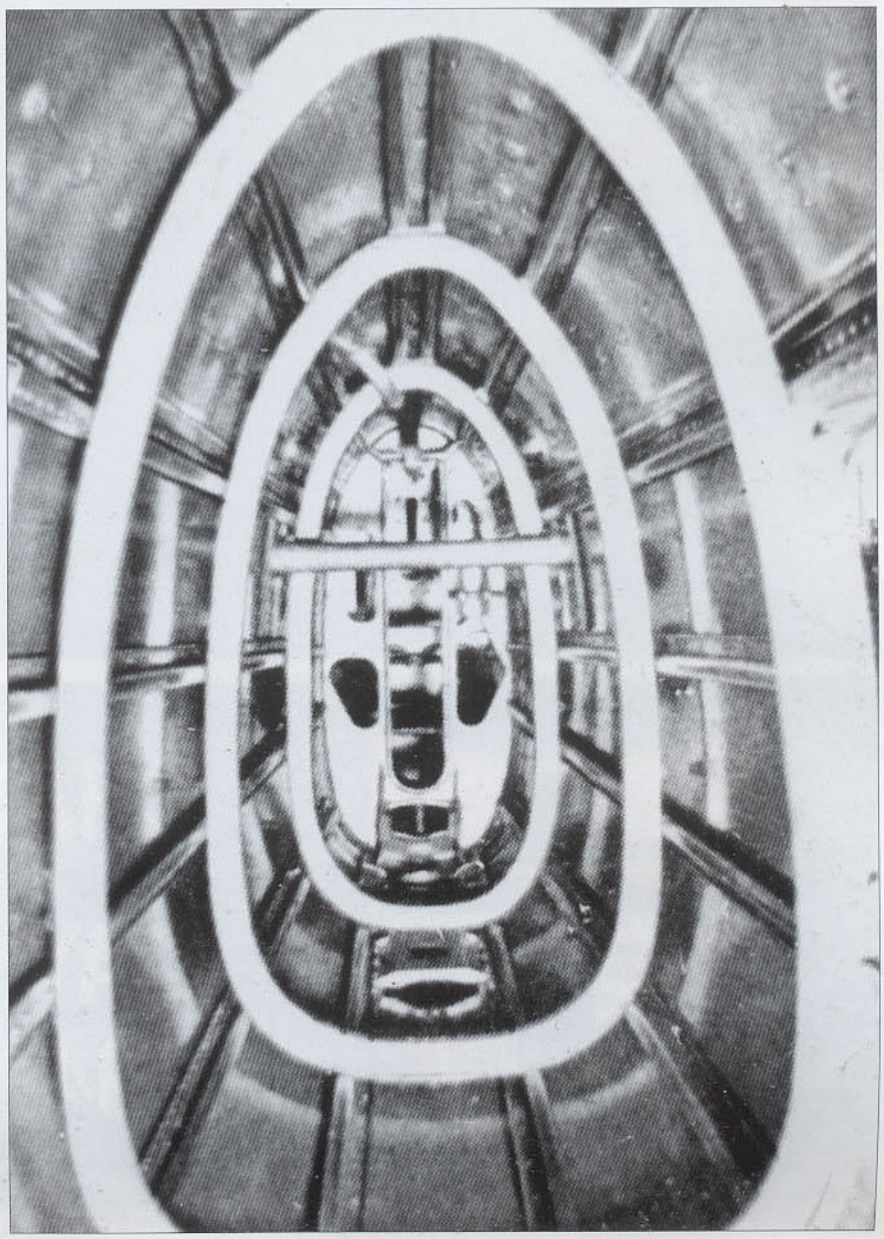
Left: Like the contemporary Messerschmitt 109, the cockpit of the He 100 D-1 was snug for an airman of average height and build. In this photograph, the pilot is being assisted by an enlisted man prior to take off.

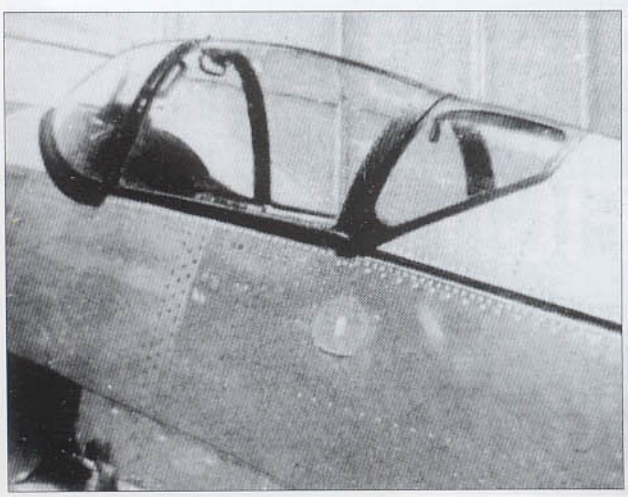
Right: An overall view of a He 100 D during the final stages of assembly. Armament was to have consisted of two 7.9 mm MG 17 machine guns mounted in the aircraft's wing roots plus a 20 mm MG FF cannon positioned in the engine to fire through the propeller shaft. Unlike Messerchmitt, Heinkel did not favor positioning machine guns over the engine. Considering the problems Messerschmitt was having trying to adapt the MG FF cannon to the engine-mounted position, it is unlikely Heinkel would have had any better results.



Right: A glimpse of the interior of the rear fuselage of the He 100 D during construction before control lines or electrical equipment had been installed.

Below: Taken during final assembly this photograph shows to advantage the aft-sliding canopy of the He 100 D-1. The two small hand grips at the top of the front bracing are to assist the pilot in leaving the cockpit. The circular hatch below the aft brace is the fuselage fuel filler point. Unfortunately, no photographs of the instrument panel of the He 100 D-0 or D-1 are known to exist. Nevertheless, based on what Heinkel provided for the He 112 B-0 (see p. 46), it is possible to speculate that a similar designwould have been selected. The aft-sliding canopy held several advantages over the side-hinged canopy favored by Messerschmitt, namely ease of ground access to the cockpit from both wings and better in-flight release. Visibility in all directions would have been about the same as for the contemporary Bf 109 E, but it is likely the forward windscreen would have provided insufficient protection from enemy fire and, like the Bf 109, it ultimately would have had to have been redesigned.





CHAPTER 3

DAY FIGHTERS 1940 – 1943

Messerschmitt Bf 109 E-4

As recounted in Chapter 2, the Bf 109 E-series appeared for the first time late in 1938 when the initial production model, the Bf 109 E-1, began rolling off the production line. This series of the Emil continued in production up until 1940, when it was superseded by the improved E-4 series. It must be noted here that, contrary to popular belief, the Bf 109 E-2 was not produced, and the E-3 series was produced in only small quantities. Introduced in May 1940, the Bf 109 E-4 was outwardly very similar to the E-3. But, unlike the E-3, the E-4 series was produced in substantial numbers well into 1941. It differed from the E-3 in several subtle respects. Whereas the E-3 was still classified as a light, single-seat fighter, the E-4 was heavier, having been fitted with 88 lb. (40 kg) of armor plate just aft of the cockpit, plus 29 lb. (13 kg) of armor behind the pilot's shoulders and head. During the Battle of Britain, both sides quickly learned the value of protecting both the pilot and the fuel supply from enemy shells. The light-weight Bf 109 E-1s, without any form of armor plate, fell prey to the concentrated firepower of the RAF. While many older E-1s and a few E-3s were retrofitted with cockpit armor, it was the E-4 which first appeared with this feature as standard equipment.

In addition, the E-4 dispensed with the 55 lb. (25 kg) of ballast formerly affixed to the rearmost part of the fuselage and incorporated a newer version of the 20 mm wing cannon, calling for lightening certain gun features while accepting a new and improved high-capacity shell. Known as the MG FF/M, this weapon was otherwise similar to the earlier model containing 60 round drums beneath underwing blisters.

Initial production aircraft of the E-4 series continued with the older cockpit, but this was gradually replaced on the assembly line with the newer, more angular type shown in the photograph at the top of this page. It should also be noted that, as in the E-1 and E-3, many of the older examples of the E-4 produced with the early cockpit canopy were retrofitted with additional armor to the windscreen and for the pilot's shoulders and head without any change to the aircraft's designation.

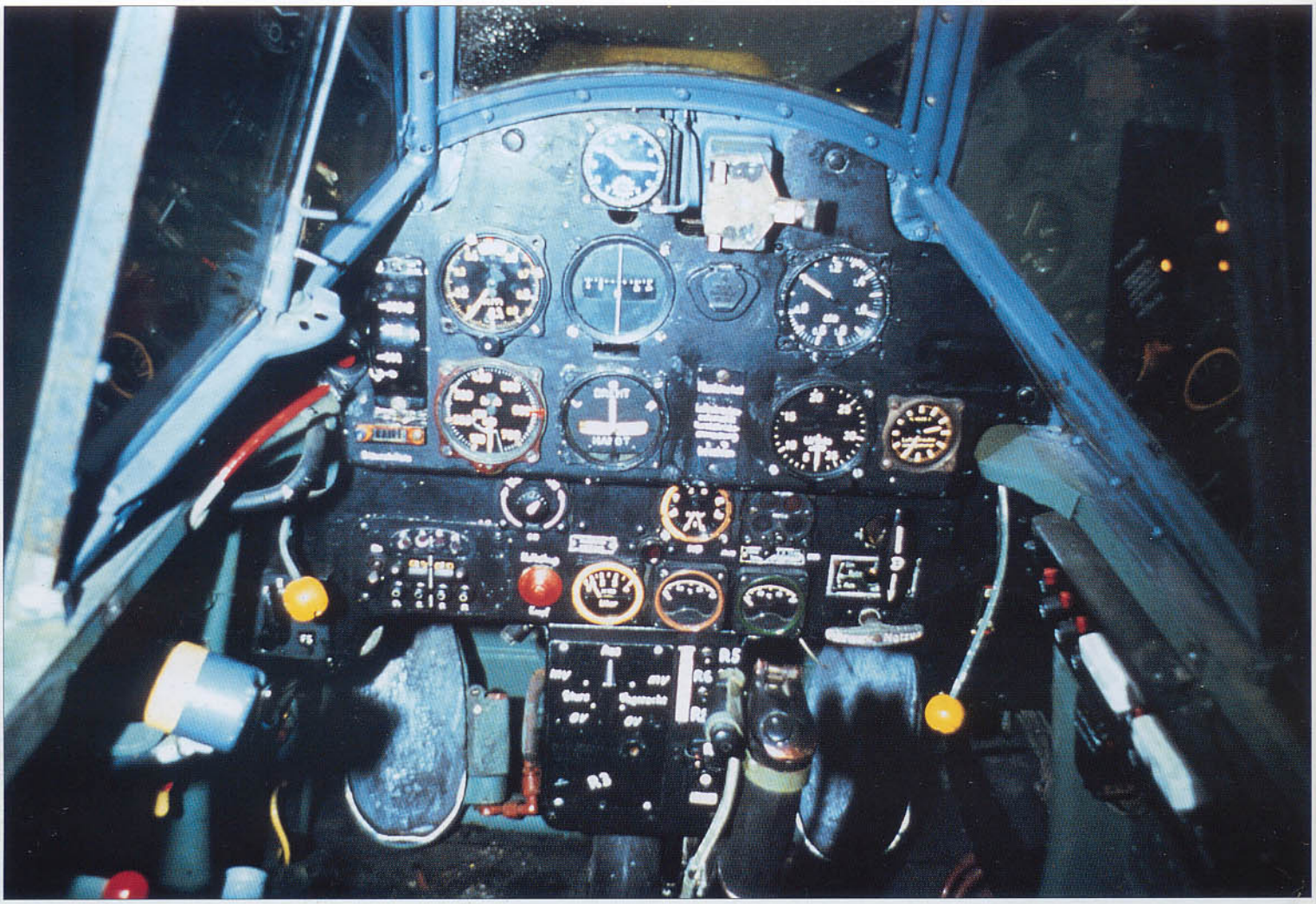
The E-4 was eligible to receive the improved Daimler-Benz DB 601N. Aircraft with this engine had their designations amended to Bf 109 E-4/N, but externally there was no identifying characteristic of those aircraft so equipped apart from a change in the fuel rating contained within the yellow and white triangle located beneath the filler point. Standard E-4s carried the number 87, or the octane code, B4, in black within the yellow triangle. Aircraft powered by the DB 601N requiring 96 to 100 octane (or C3 fuel) had this information painted within the yellow filler-point triangles.

In addition, the E-4 series could be adapted for the fighter-bomber role (Jabo). These aircraft were fitted with a special bomb rack beneath the fuselage for one 551 lb. (250 kg) bomb known as the ETC 500, or the ETC 50 bomb rack designed to carry four 110 lb. (50 kg) bombs. The designation of these fighter-bombers was amended by adding the letter B after the subtype to become the E-4/B. Inside the cockpit, a special arming panel was centrally mounted beneath the main instrument panel which is described elsewhere within this book.

Aircraft intended for operations in north Africa were fitted with various equipment for use in the desert, including sand filters to the supercharger intake and special coolant devices, coolers for the oil, improved generator ventilation, special survival equipment and white-wall tires to reflect direct sunlight. These aircraft were known as Bf 109 E-4/tp or, alternatively, E-4/trop aircraft.

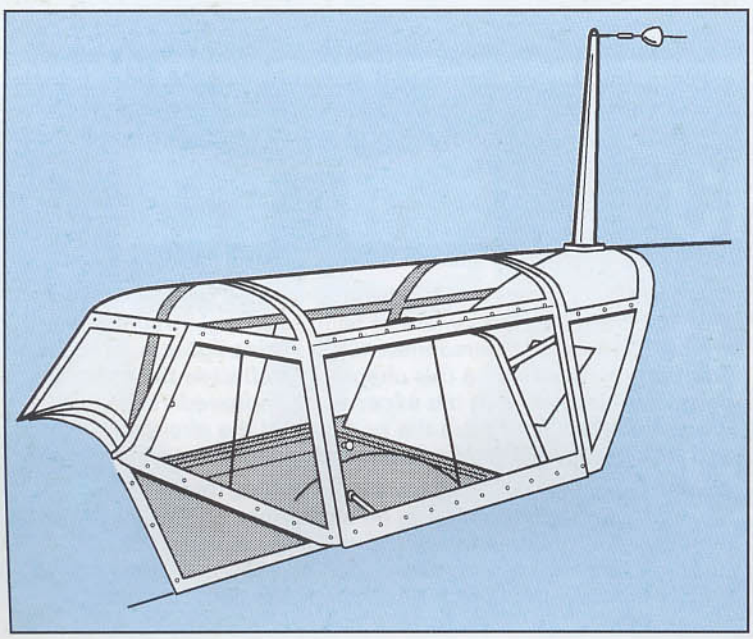
Opposite left: Close-up of the starboard side of the canopy for a Bf 109 G-6. This heavy (about 50 lb - 22.7 kg) structure was typical for most Messerschmitt 109 G-series fighters of the mid war period discussed in this chapter. It reflected the need for better protection but at the expense of improved visibility. Hinged to open only from the port side of the aircraft, the center and rear sections could be jettisoned in flight in an emergency.

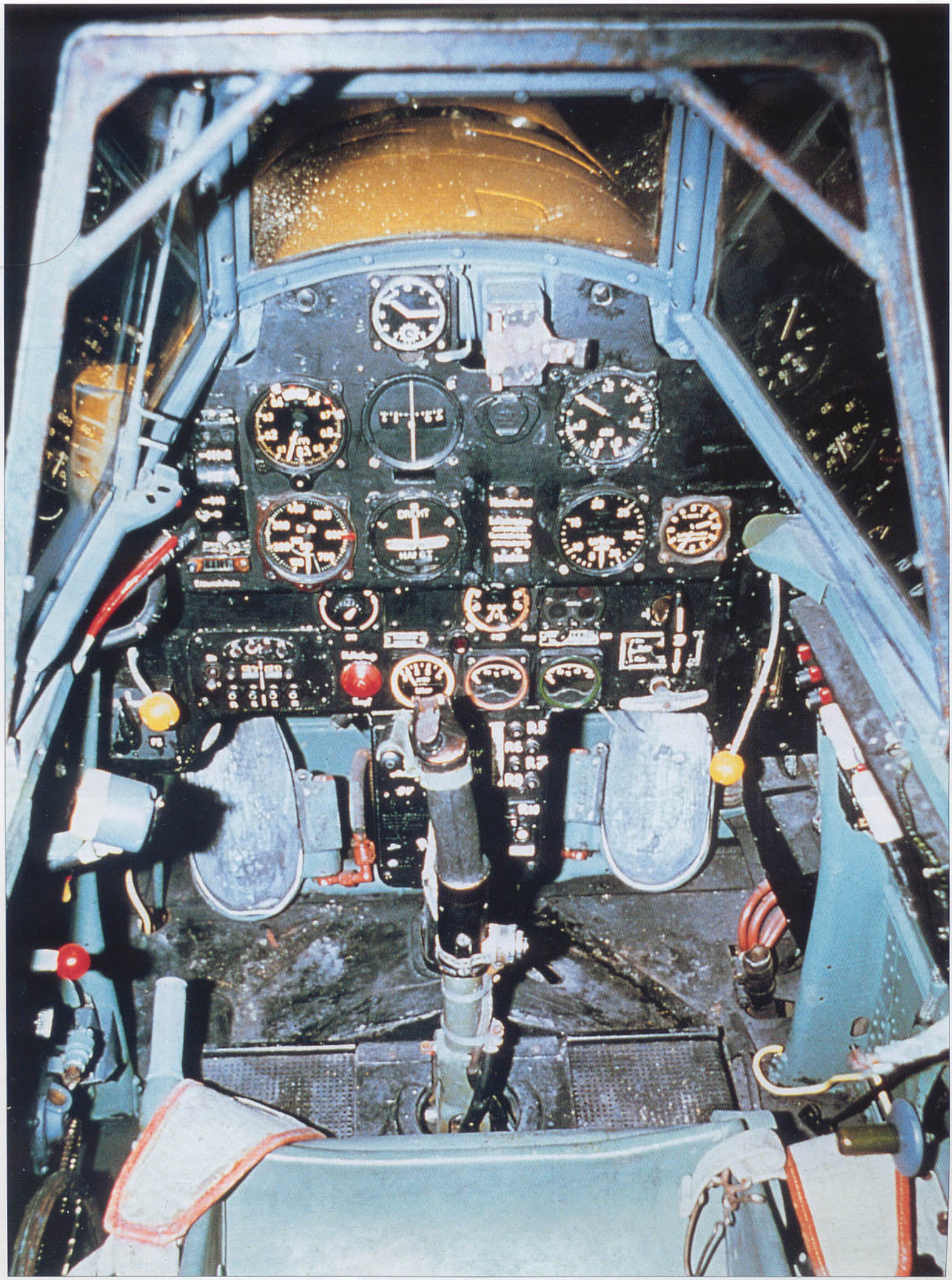
Above: This Bf 109 E-4, W.Nr. 4101, GH+DX, black 12, of 2./JG 51, was captured at Manston on November 27, 1940, after its pilot made a forced landing following action with RAF Spitfires.The aircraft was extensively tested and is now on display at the Royal Air Force Museum at Hendon, London.

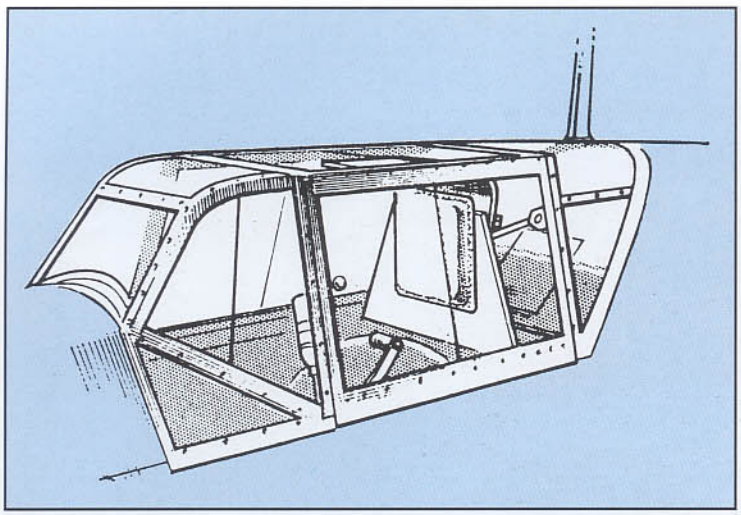


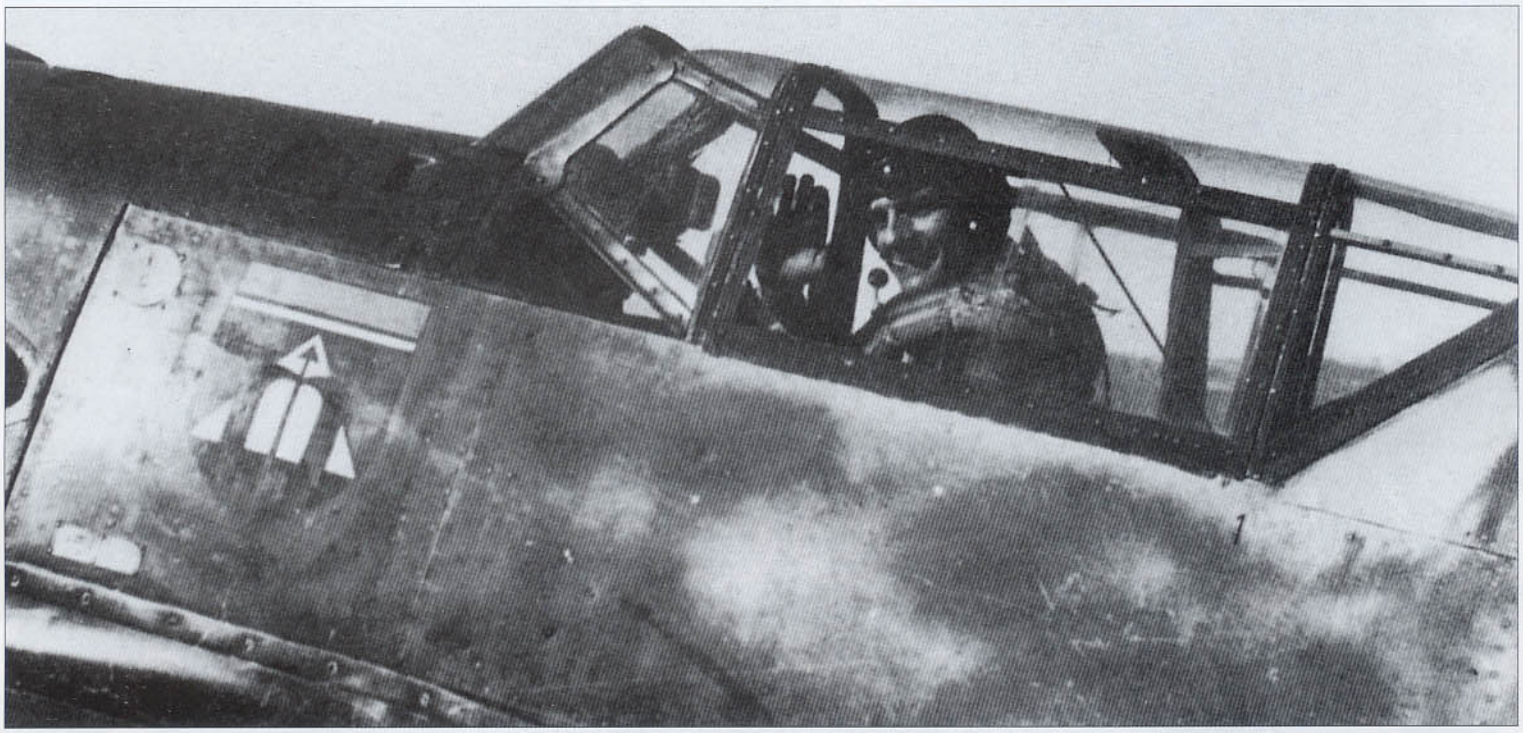
Above and opposite: An overall view of the instrument panel and cockpit for the Bf 109 E-4, W.Nr. 4101, as it exist today. This aircraft is equipped with all of the standard equipment common to the E-4 series. Soon after its capture on November 27, 1940, it was repaired and flown on February 25, 1941 wearing British insignia and carrying RAF serial number DG200. Over the next year it was extensively flown, but by 1943 it was finally grounded and set aside for museum storage. In 1972 it was fully restored while at RAF At. Athan where it remained until 1980 when it was transferred to its permanent location at the Royal Air Force Battle of Britain Museum at Hendon.

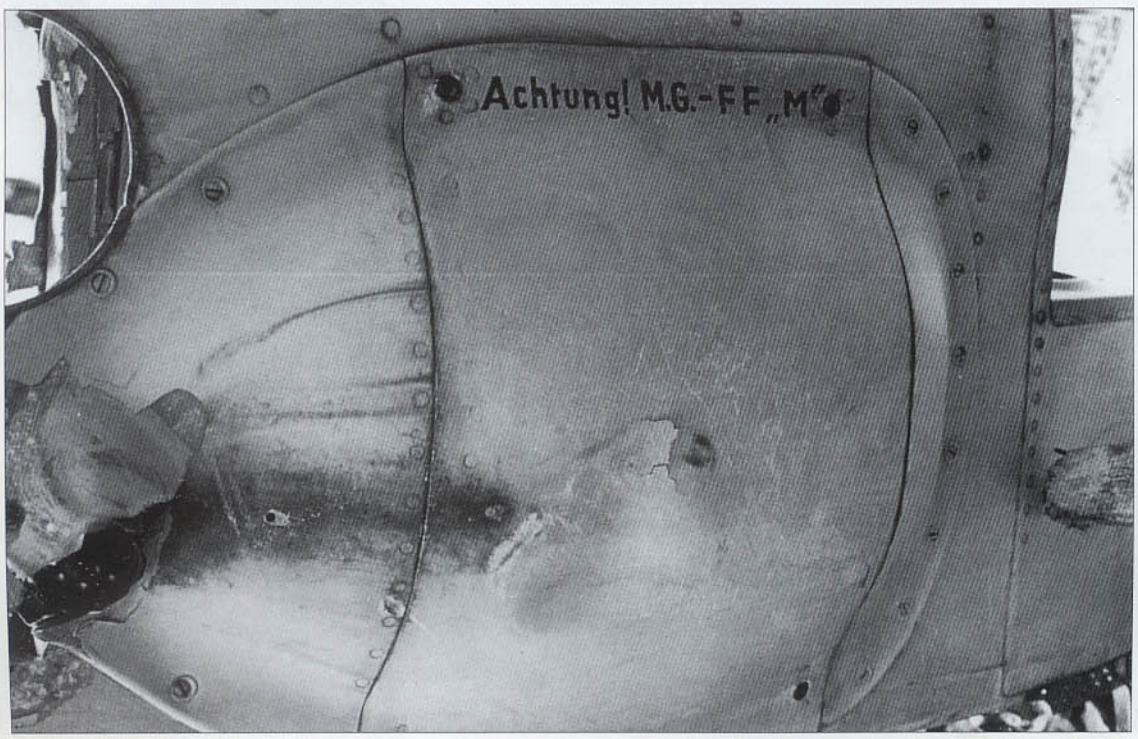
Below: The E-4 series was initially fitted with the same canopy installation as the E-3, but differed in having shoulder and head armor as standard equipment. However, relatively few E-4s were completed with the older canopy before it was replaced by the more angular design shown to the right and on top of page 84.









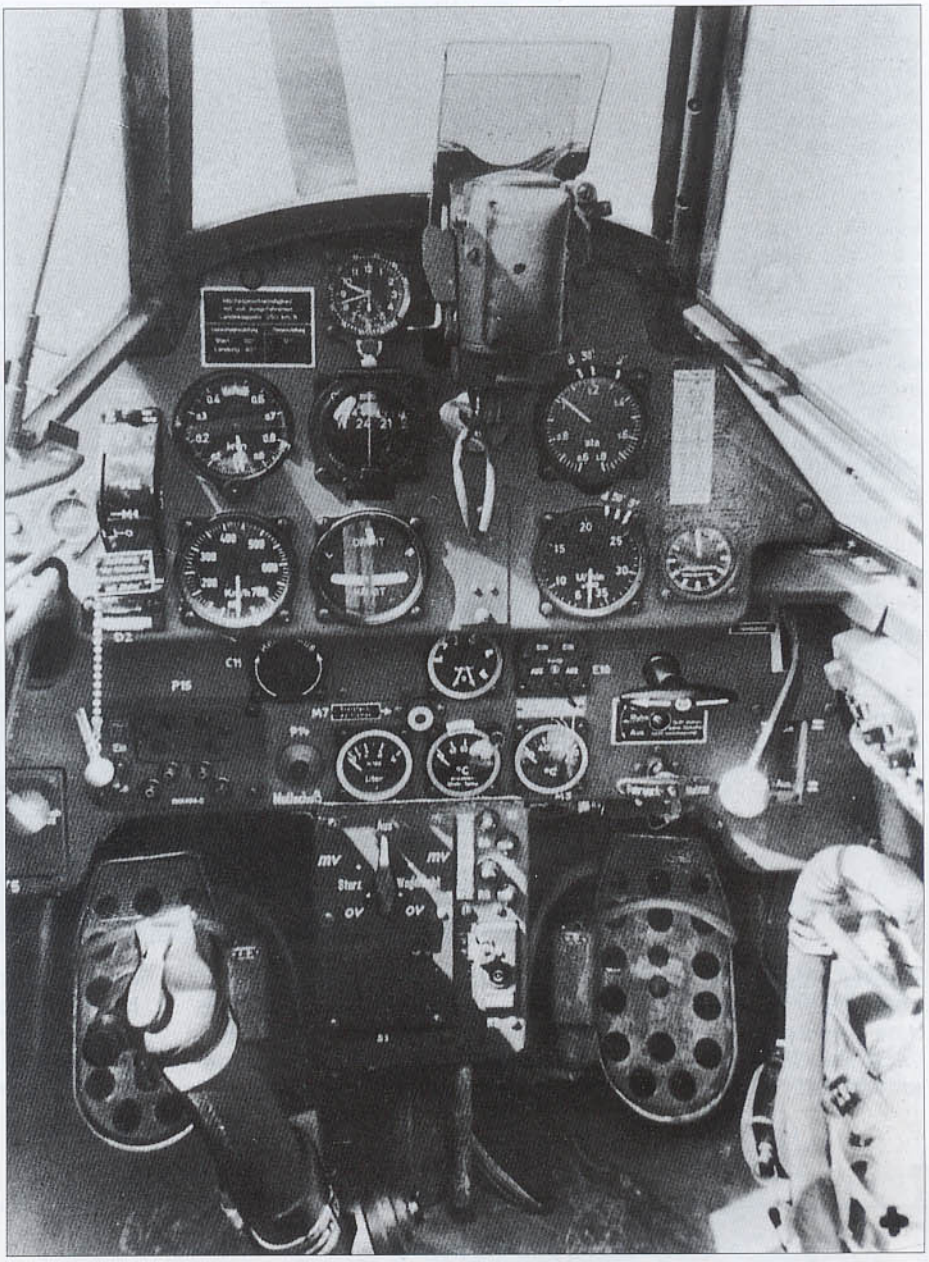


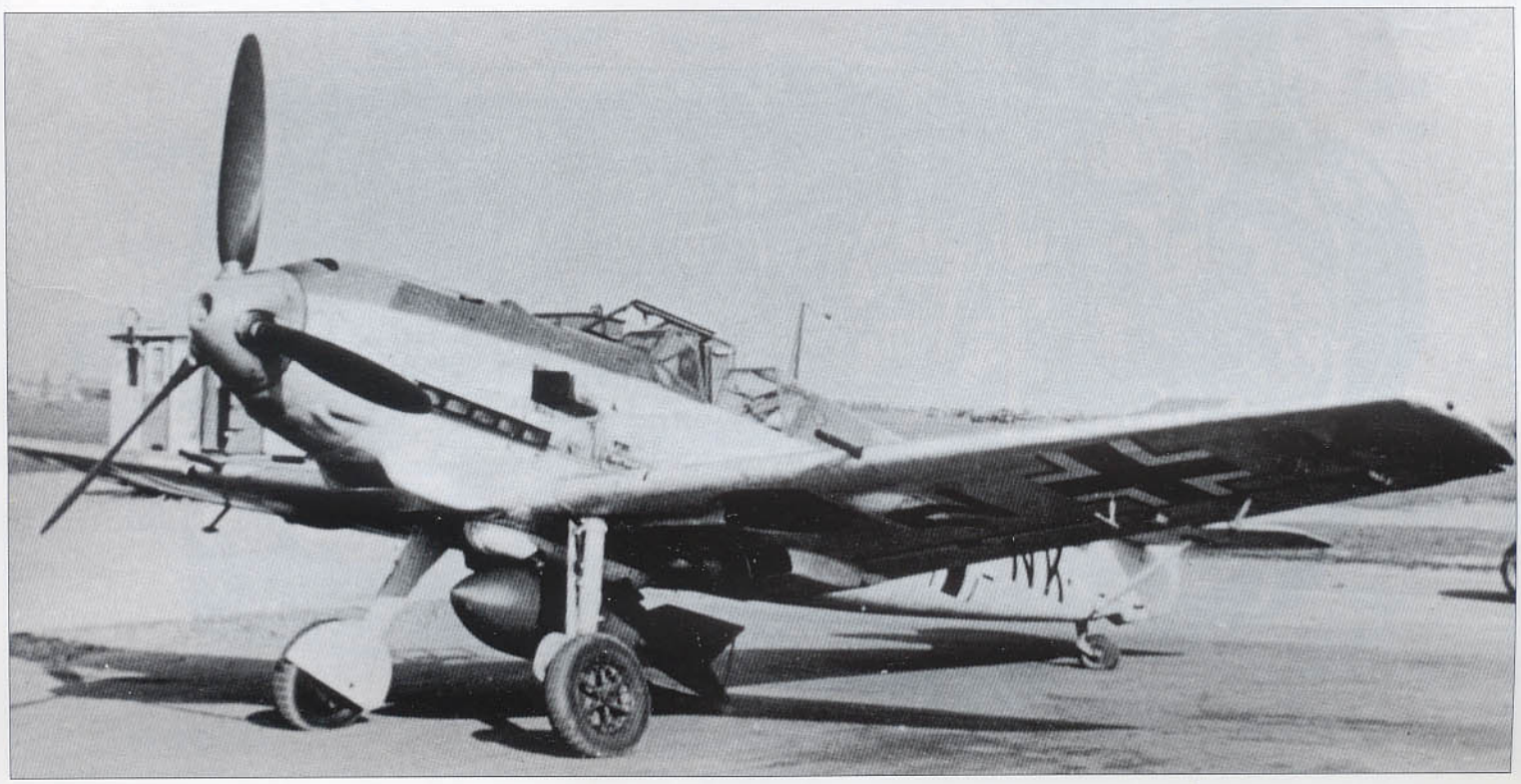
Top left and right: The new angular canopy and windscreen first appeared on the assembly line with the E-4 series. It incorporated slightly heavier braceing within the windscreen and canopy center section, which allowed for heavier shoulder and head armor while at the same time, eliminating the need for curved pieces of plexiglas along top portions.

Above: A close-up of a pilot in the cockpit of an early production E-4 attached to *Jagdfl. Schule 2.* Note that this particular aircraft has been retrofitted with heavier (58 mm) windscreen bullet-resistant glass and additional back and head armor.

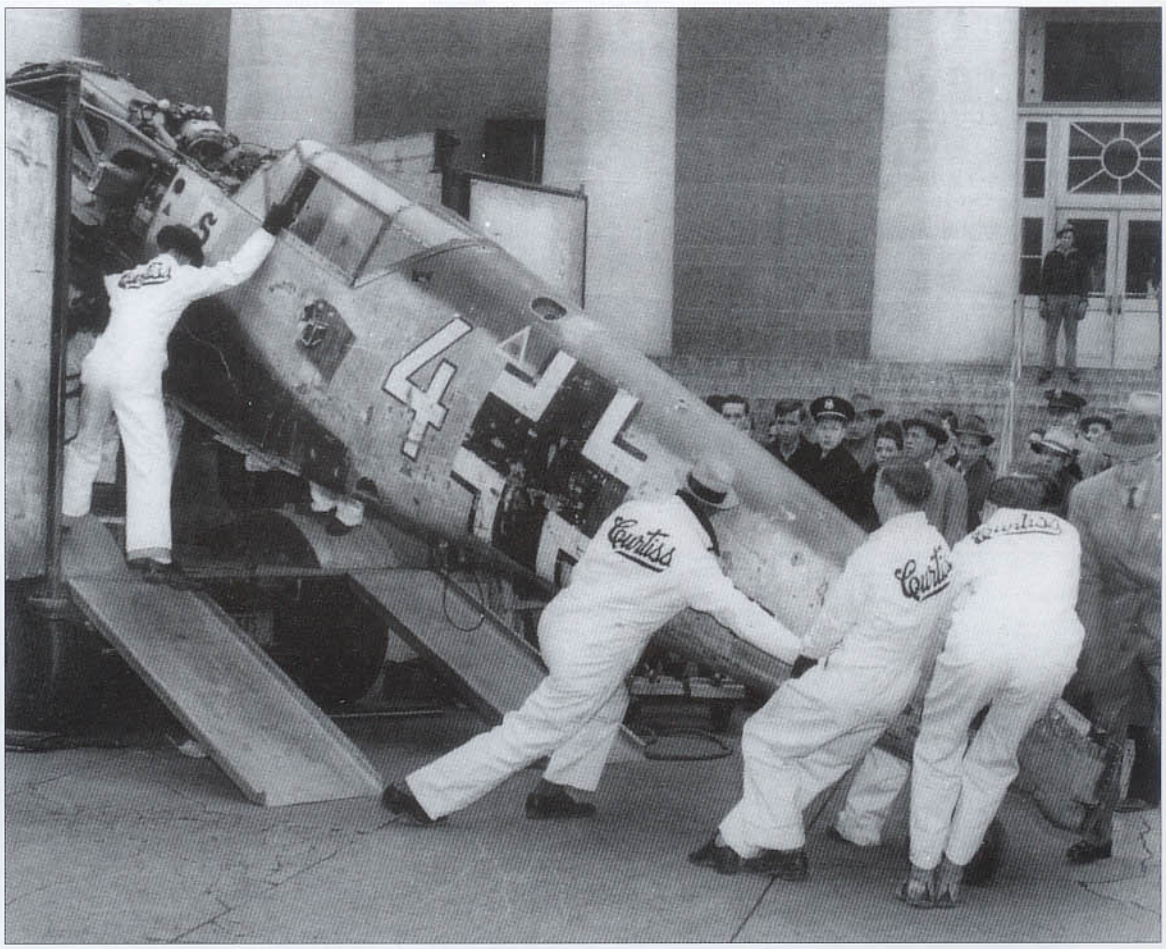
Left: Close-up of the underwing pan housing the magazine drum for the new MG FF/M cannon.

Right and below: The Bf 109 V26, W.Nr. 1361, CA+NK, was a standard E-4 modified to carry a SC 250 bomb weighing 551 lb (250 kg), mounted beneath the fuselage on an ETC 500 bomb rack. Tests proved the feasibility of the idea which then allowed a substanical number of E-4s to be fitted with the necessary equipment to be classified as Jabo, or fighter-bombers under the designation Bf 109 E-4/B. Note that the standard E-4 instrument panel has been modified by the addition of a special bomb release fixture mounted below the lower center of the panel. In addition to the tests carried out with one SC 250 bomb, a special ETC 50 bomb rack was manufactured to enable the E-4 to carry four of the smaller SC 50 bombs (110 lb - 50 kg) arranged in tandem pairs. This configuration was also identified as a Bf 109 E-4/B.



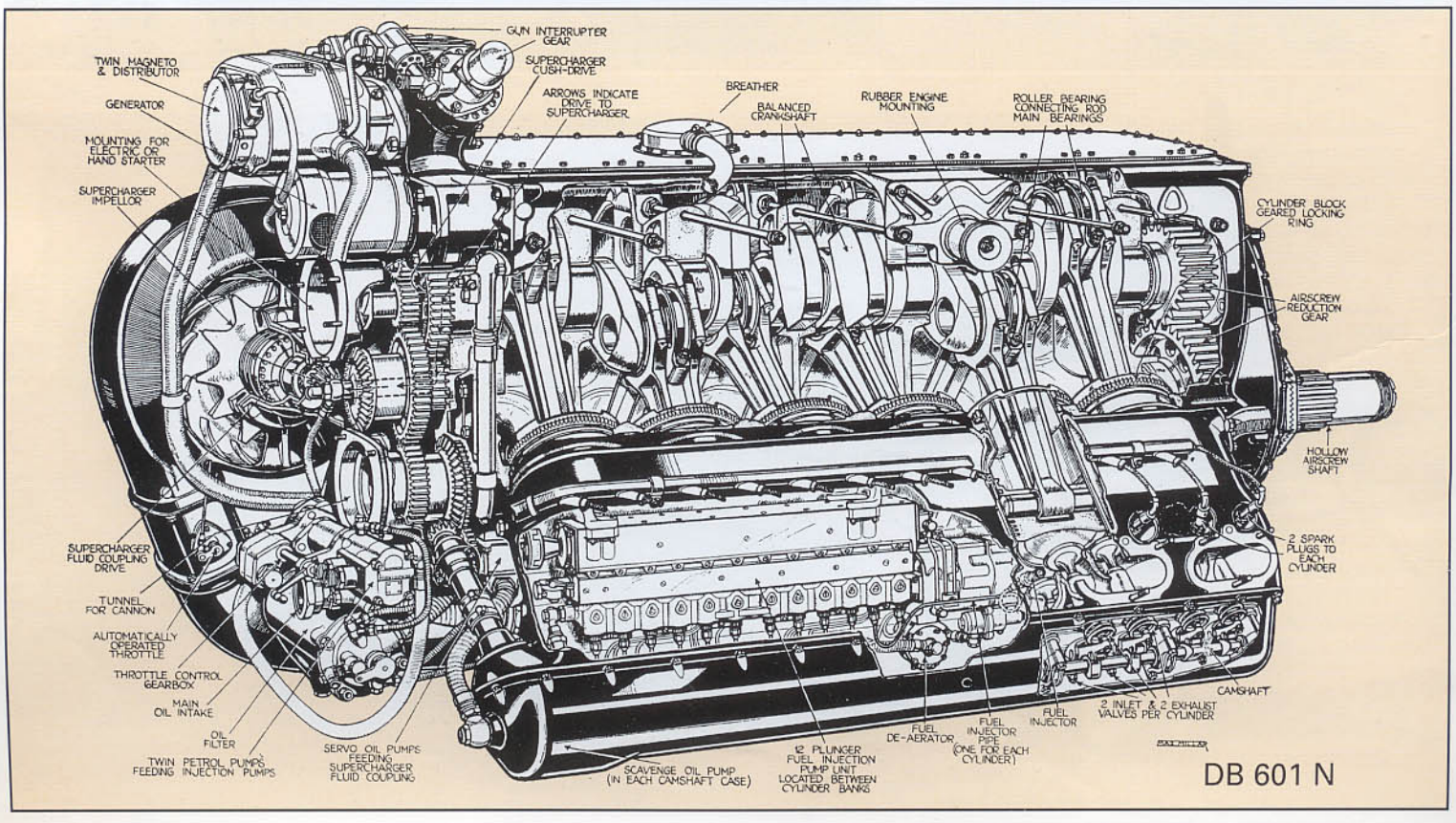


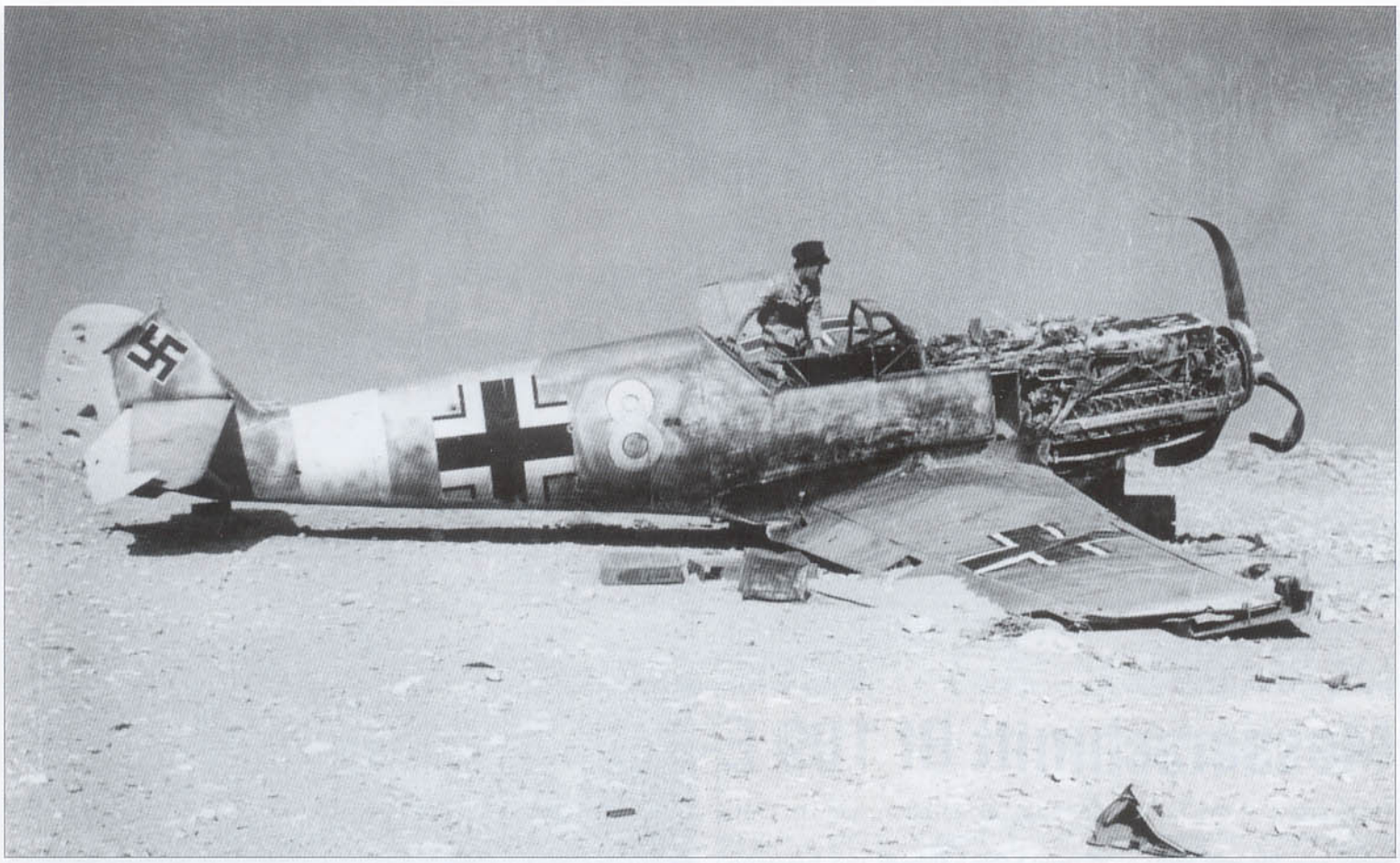
Right: Curtiss workmen manhandle the fuselage of Bf 109 E-4/N, W.Nr.1190, white 4, upon its arrival in New York from Canada. Piloted by *Uffz.* Horst Perez of 4./JG 4, this early production Emil was shot down at East Dean, near Eastbourne, on September 30, 1940. The small fuel rating triangle, immediately below the fuel filler point, located to the left of the national aircraft insignia, carries the number "100" indicating that this aircraft was fitted with the DB 601 N engine which required fuel of 96 to 100 octane. Interestingly, the remains of this aircraft still exists within a private collection in the south of England.



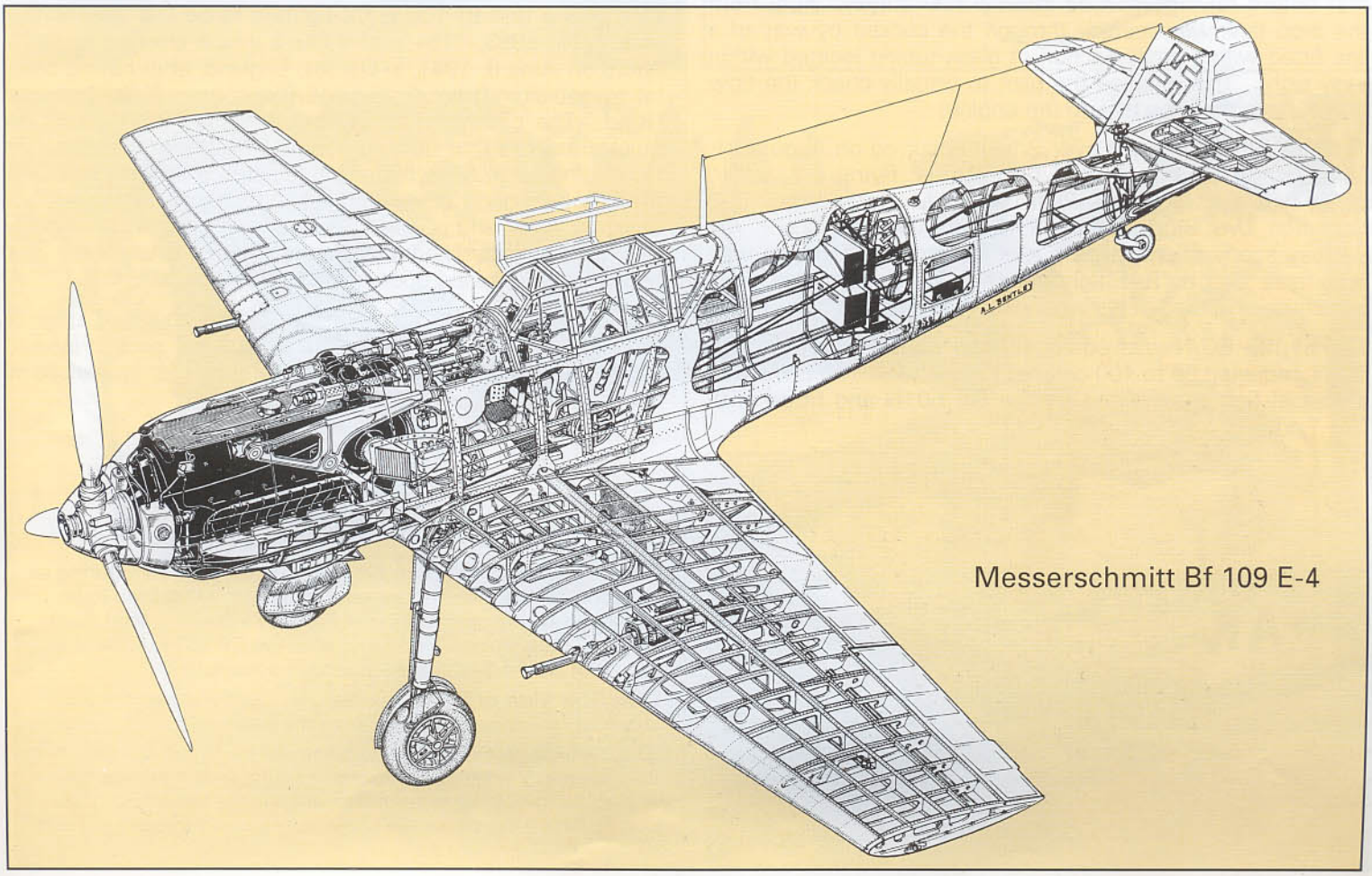
Opposite top: The remains of a Bf 109 E-4/N Trop, white 8, in north Africa. Note the letter "N" a top the engine just aft of the propeller, indicating the engine to be the DB 601 N.

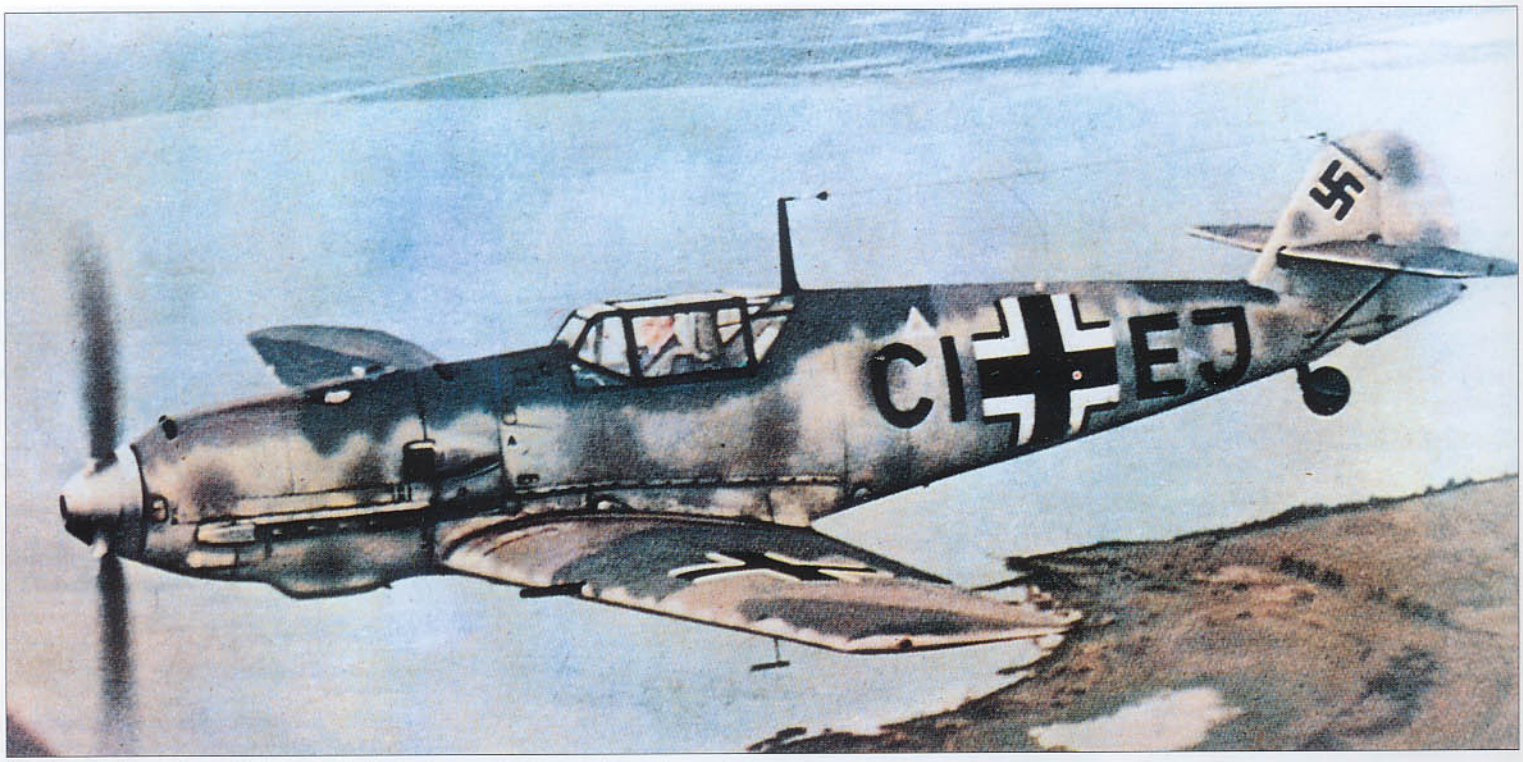
Below: This superb drawing of a DB 601 N shows the major internal components of this 33.9 litre engine which was an alternate powerplant for the Bf 109 E-4 series. It was outwardly similar to the DB 601 A-1, but was fitted with a higher compression ratio of 8.2 : 1 (in place of the normal 6.5 : 1 of the A-series), requiring C3 fuel of at least 100 octane, and developing 1,175 hp for take off at 2,600 rpm. Production of the 12-cylinder, liquid-cooled, DB 601 N began in 1940 and was either assigned as the primary engine to a particular series of Messerschmitt fighters, or was available as an alternate powerplant to others.





Above: A British officer examines the remains of a Bf 109 E-4/N Trop, white 8, of I./JG 27, forced landed in 1941somewhere in Libya. This particular Emil was equipped with the DB 601 N as indicated by the letter "N" painted at the top front of the engine. German pilots who had to force land behind enemy lines faced a harsh and unforgiving landscape.





Messerschmitt Bf 109 E-7

This variant of the Emil series first appeared in August 1940, and primarily differed from the E-4 because of its ability to carry one 79 gal. (300 litre) drop-tank beneath the fuselage. This enabled the E-7 to extend its range of operation, which was becoming an increasingly important factor to the *Luftwaffe.* A special modification to the fuel line was incorporated which allowed the fighter to draw upon the drop-tank first before relying upon its internal fuel supply. Fuel from the drop tank was routed through the cockpit by way of a line fitted with a small section of glass tubing located within easy sight. This enabled the pilot to visually check the flow of fuel from the drop tank to the engine.

The first Bf 109 E-7 lost over Britain occurred on August 31, 1940, when *Oberlt.* Hasso von Perthes, flying E-7, W.Nr. 5600, was shot down by Pilot Officer M. Feric of No. 303 Squadron over Biggin Hill at 18:45 hrs. Although *Oberlt.* von Perthes successfully bailed out of his stricken Emil, he was reportedly shot by RAF fighters while still descending in his parachute. He died of his wounds two weeks later.

The Bf 109 E-7/N was equipped with the Daimler-Benz DB 601N, requiring 96 to 100 octane fuel. The Bf 109 E-7/Z was a special fighter powered by the DB 601N and fitted with GM 1 powerboost.

Aircraft fitted with this powerboosting system allowed the pilot to fly above the rated altitude of the engine for short periods. GM-1 was the code name for nitrous-oxide (N_2O) contained under pressure in liquid form. During February 1941, eighty E-7s were modified to accept GM-1 thus becoming E-7/Z variants, the "Z" indicating *Zusatzgerät* (supplementary apparatus).

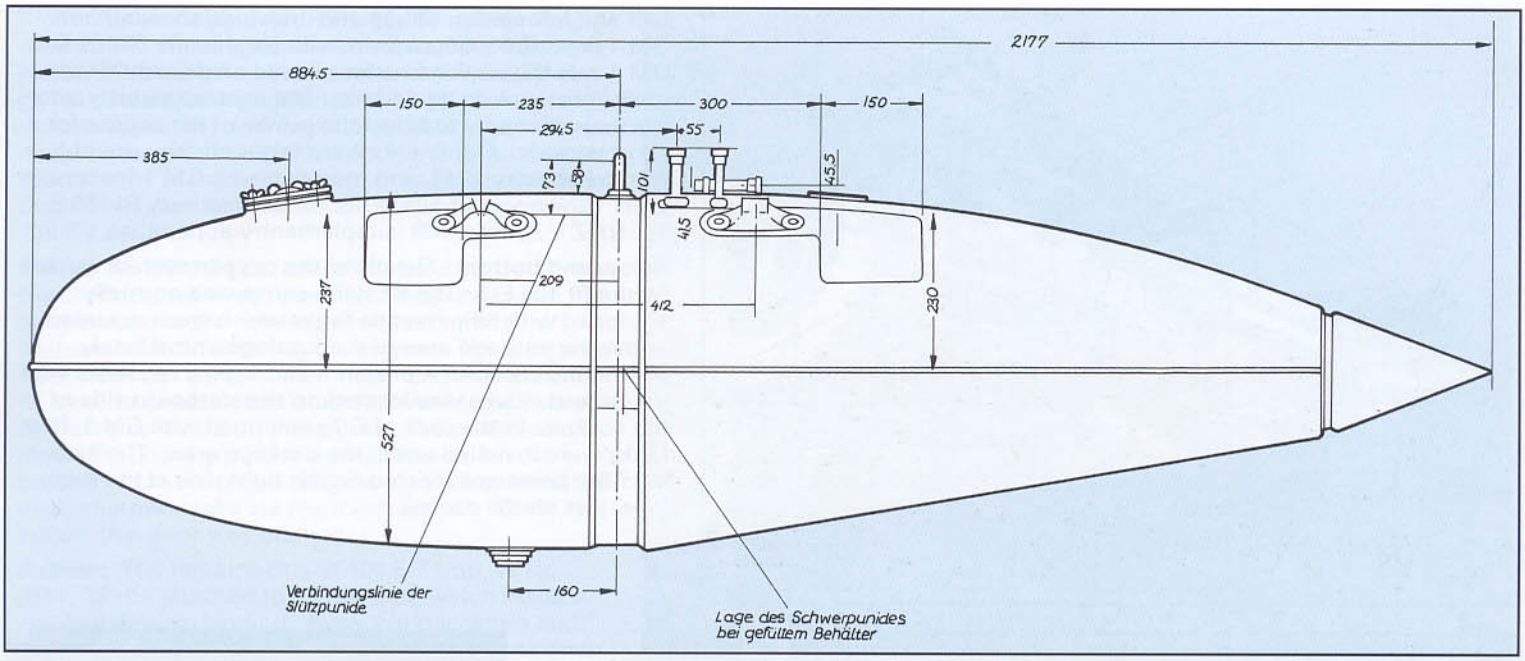
One of the first Bf 109 E-7/Z fighters to be lost over Britain was W.Nr. 5983, "15+", of 7./JG 2 which crashed at 14:25 hours on June 9, 1941, in Dorset, England, after having been hit by anti-aircraft fire from HMS Blencathra off St. Aldhems Head. The pilot, *Oberlt.* Werner Machold (Staffelkapitän) quickly realized that he was about to be taken prisoner after his engine seized. He therefore selected a suitable site, and then made a good wheels-up landing. His aircraft, manufactured by WNF, and powered by a DB 601 N-1, W.Nr. 21705, manufactured by Niedrsachsische MW of Brunswick, was thoroughly examined upon capture.

The Bf 109 E-7 was also eligible for the so-called tropical modification described under the Bf 109 E-4 section (see p. 81) as the Bf 109 E-7/tp which was intended for operations in North Africa.

Above: This Bf 109 E-7, W.Nr. 2574, CI+EJ, is shown during an acceptance flight in August 1940. It was the first Emil to be equipped with a special carrier for the 79 gal (300 litre) auxiliary fuel tank. It was also fitted with the DB 601 N (described on p. 86) as the designated standard powerplant.

Left: This view of Bf 109 E-7, VL+AK, clearly shows the auxiliary fuel tank suspended beneath the fuselage.

Opposite page: Various views and details of the 79 gal (300 litre) fuel tank. This aluminum tank, weighing approximately 15 lb (6.9 kg) empty, was universally used within the *Luftwaffe,* on a wide range of aircraft, from 1940 until the end of the war.


2177
884.5
150
235
300
150
294.5
55
385
73
58
101
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415
237
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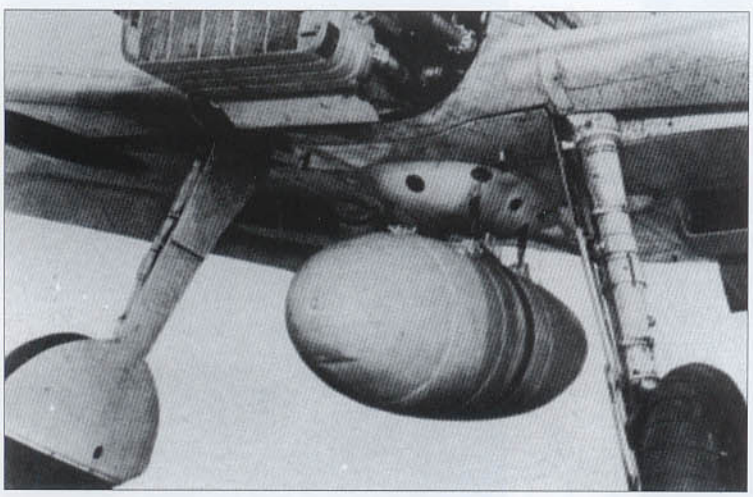
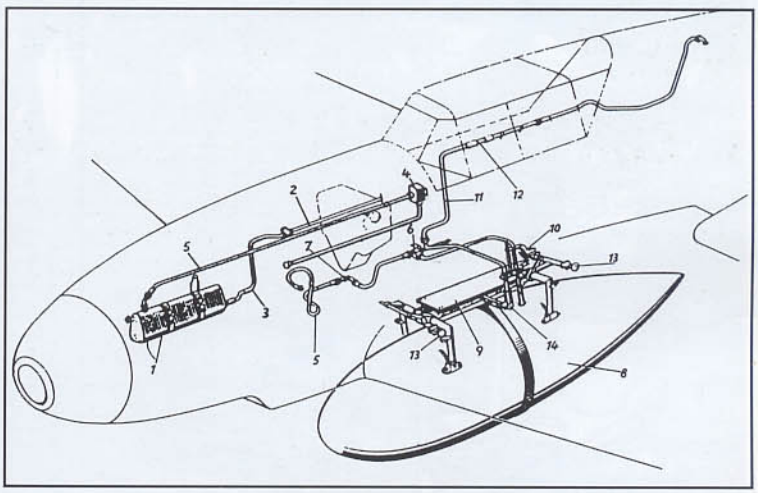
230
527
160
Verbindungslinie der Stützpunide
Lage des Schwerpunides bei gefülltem Behälter

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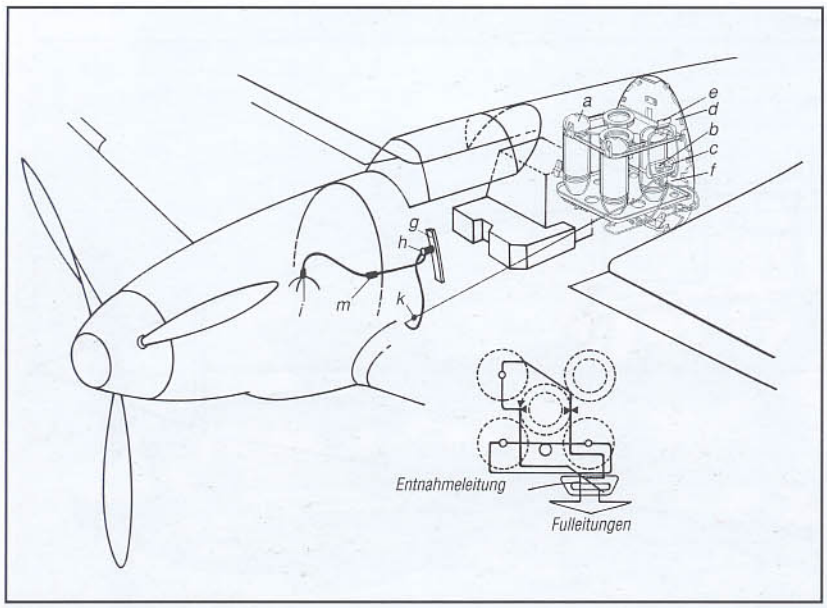
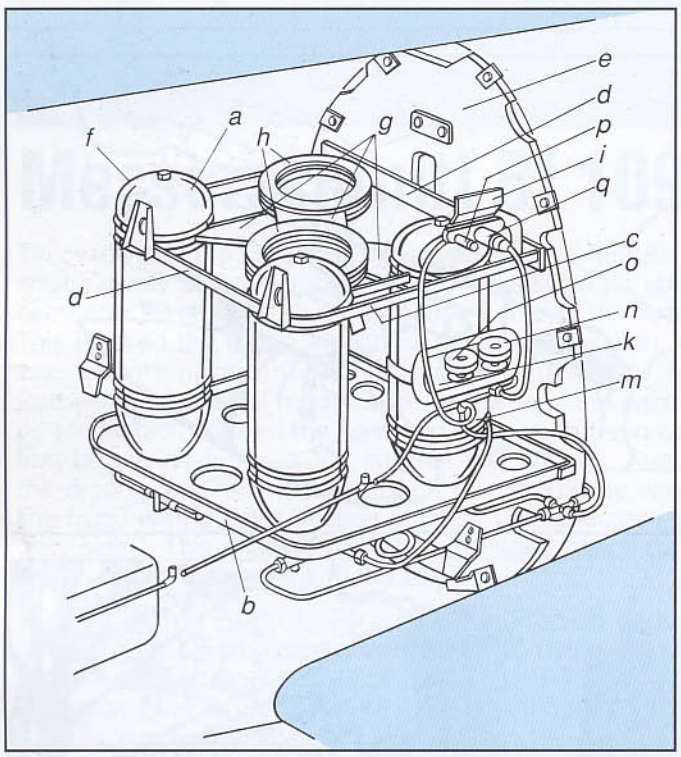
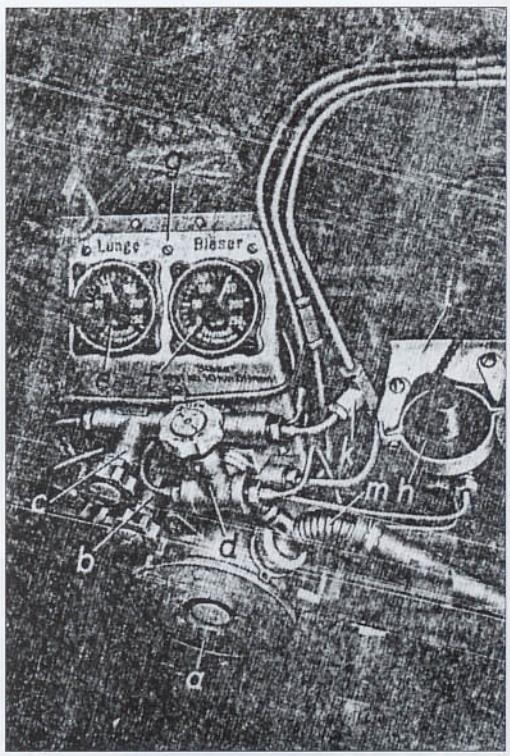


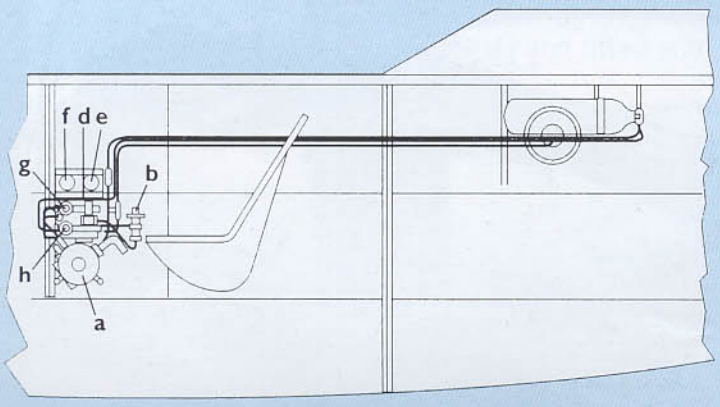
Left and left center: Schematic drawings showing how GM 1 powerboosting was installed within the Bf 109 E-7. GM 1 was the code name for nitrous-oxide, contained under pressure, in liquid form, and injected directly into the fuel-air supply to boost the power of the engine for short periods. Eighty E-7s were taken off the assembly line in February 1941, and modified with GM 1 for service trials. Known as Bf 109 E-7/Z (or alternatively Bf 109 E-7/Z-N) Z = *Zusatzgerät* (supplementry apparatus).

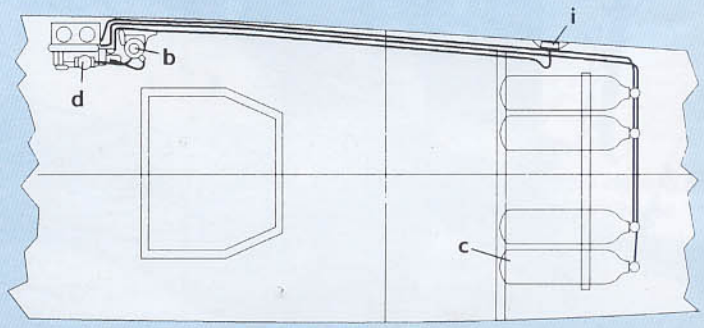
Below and bottom: Details of the oxygen system carried by the Bf 109 E-7. The Bf 109 E-series was normally equipped with twin oxygen tanks which were mounted under the package area of the fuselage immediately behind the cockpit. A pressure and supply regulator with gauge and valves was located on the starboard side of the cockpit. In the case of E-7s equipped with GM 1, four tanks were installed under the package area. The external filler point was located on the right side of the fuselage, just aft the cockpit.



a. Lutz designed bottles
b. Base plate
c. Support brace
d. Support container
e. Armor plate
f. Auxiliary frame
g. Position spacers
h. Filling rings
i. Container plate
k. Support frame
m. Filter
n. Filler valve
o. Pump valve
p. Pump cover
q. Filler cover





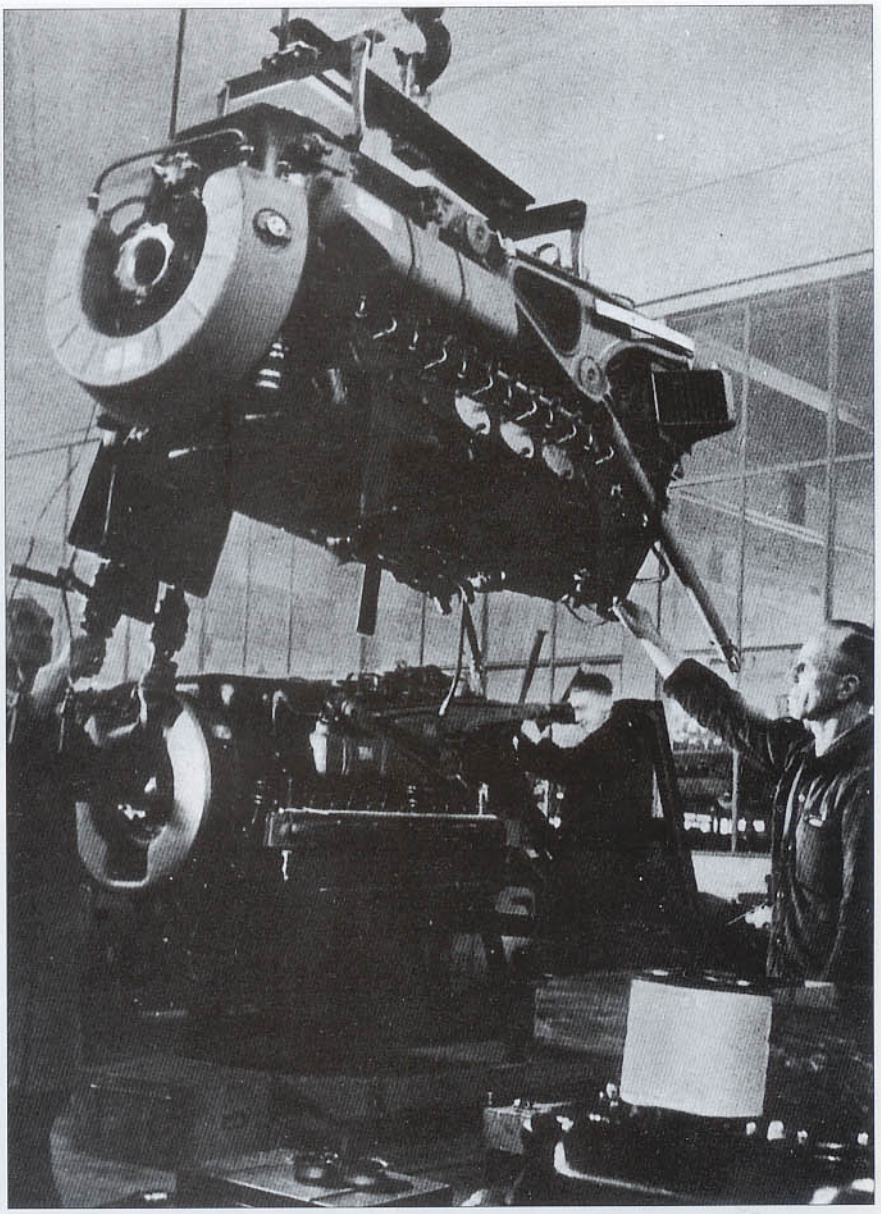


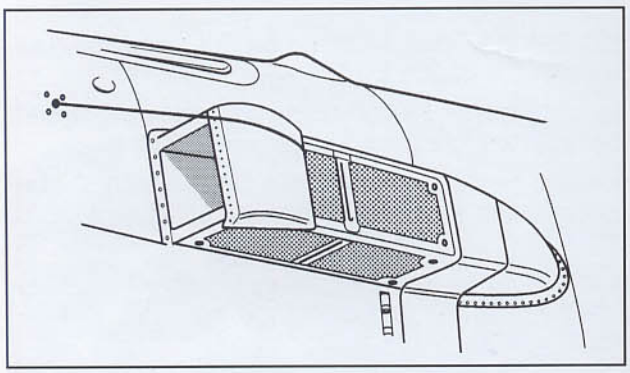
a. Standard Pump
b. Pressure reducer
c. Oxygen bottles
d. Oxygen shut-off switch
e. Pressure gauge for oxygen flow
f. Pressure gauge for high altitude operations
g. Oxygen bottle switch for high altitude flight
h. Oxygen bottle switch for gas feed
i. External filler point

Right: Messerschmitt workers gently maneuver a new DB 601 N-1 engine, destine for a Bf 109 E, complete with its engine bearer arms, U-shaped Ethyl-glycol coolant tank positioned beneath the engine reduction gearing and two 2.3 gal (9 litre) auxiliary oil tanks mounted below and forward of the engine bearer arm. In the background may be seen another DB 601 N-1, but with collar tanks adopted by the Bf 109 F-2 series.

Below: Bf 109 E-7 trop aircraft destine for duty in North Africa, were equipped with a special sand filter mounted to the cowling designed to filter airborne sand from entering the engine. The filter was equipped with a fine-screen mesh on three sides of its box-like construction plus a moveable baffle door at the front. While on the ground, the pilot closed the baffle door by pulling a small handle on the lower instrument panel. Engine air then entered the supercharger intake via the mesh screen. Once in the air, this door was opened.

Bottom: The remains of a Bf 109 E-7 trop, W.Nr. 6431, S9+IS, attached to 8./SKG 210, which made a good wheels-up landing. Note that the center and rear sections of the canopy are missing. Pilots often jettisoned these in an emergency for fear of being trapped should the aircraft flip upon landing.





Messerschmitt Bf 109 F-2

When the Bf 109 F-2 began leaving the Erla assemby line in January 1941, it was the first fighter of the new series to be equipped with the new 15 mm MG 151 aircraft cannon. This engine-mounted weapon had a phenomenal rate of fire for its day. If the pilot depressed the firing button for 13¼ seconds, he would have expended the entire 200 rounds of ammunition carried by the aircraft. In addition to its armament, the Bf 109 F-2 also incorporated a number of features quite distinct from the earlier E-series.

The most noticeable characteristic of the new Friedrich series was the aerodynamic refinement of the airframe. This included a new spinner, borrowed from the Me 210, a new streamlined cowling, a new wing with eliptical tips, a new and novel underwing radiator system, and finally a new non-braced horizontal tailplane.

In spite of the high performance aircraft cannon, mentioned above, many *Luftwaffe* pilots were skeptical about the series' firepower. Whereas the Bf 109 E-7, which was still on the production line, was armed with two machine guns and two aircraft cannons, the F-2 had only two machine guns mounted over the cowl plus the engine-mounted MG 151/15. The young German airmen realized only too well that this array was in distinct contrast to opposing British fighters. While rifle caliber machine guns used by both Hurricanes and Spitfires were proving ineffective against the armor plate of the Bf 109, the two 20 mm cannon armament of the Spitfire VB left the German pilots at a disadvantage.

The F-2 series was powered by the Daimler-Benz DB 601 N which developed 1,175 hp at 17,000 feet (5,212 m) which required 96 to 100 octane fuel known as C3. This engine has been discussed earlier since it also powered both the Bf 109 E-4/N and the Bf 109 E-7/N.

The new Bf 109 F-2 was eligible to receive a number of auxiliary items depending upon its mission. These are as follows:

R1 – A special ETC 500/IXb bomb rack mounted beneath the fuselage for carrying a SC 250 bomb.

R2 – Four special ETC 50 VIIId bomb racks mounted under the fuselage for carrying up to four SC 50 bombs.

R3 – A 300 litre drop tank could be carried under the fuselage as on the Bf 109 E-7.

R4 – A special under fuselage fitting to enable the aircraft to carry up to eight small anti-personnel bombs.

R5 – Thought to be the installation of a single Rb 20/30 camera mounted in the rear fuselage for aerial reconnasissance duties.

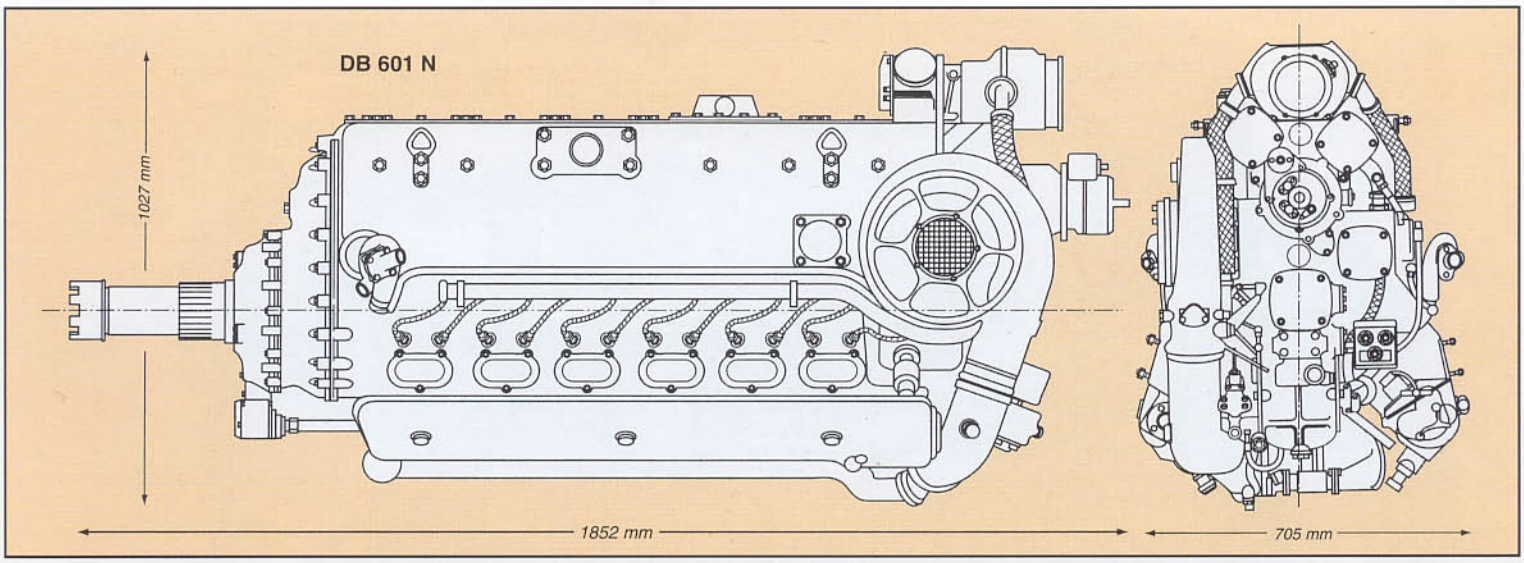
R6 – Four EGRZ 65 air-to-air, or air-to-ground rockets, were mounted beneath each wing in special fairings.

R7 – Two 20 mm MG 151/20 aircraft cannon carried in special under wing gondolas.

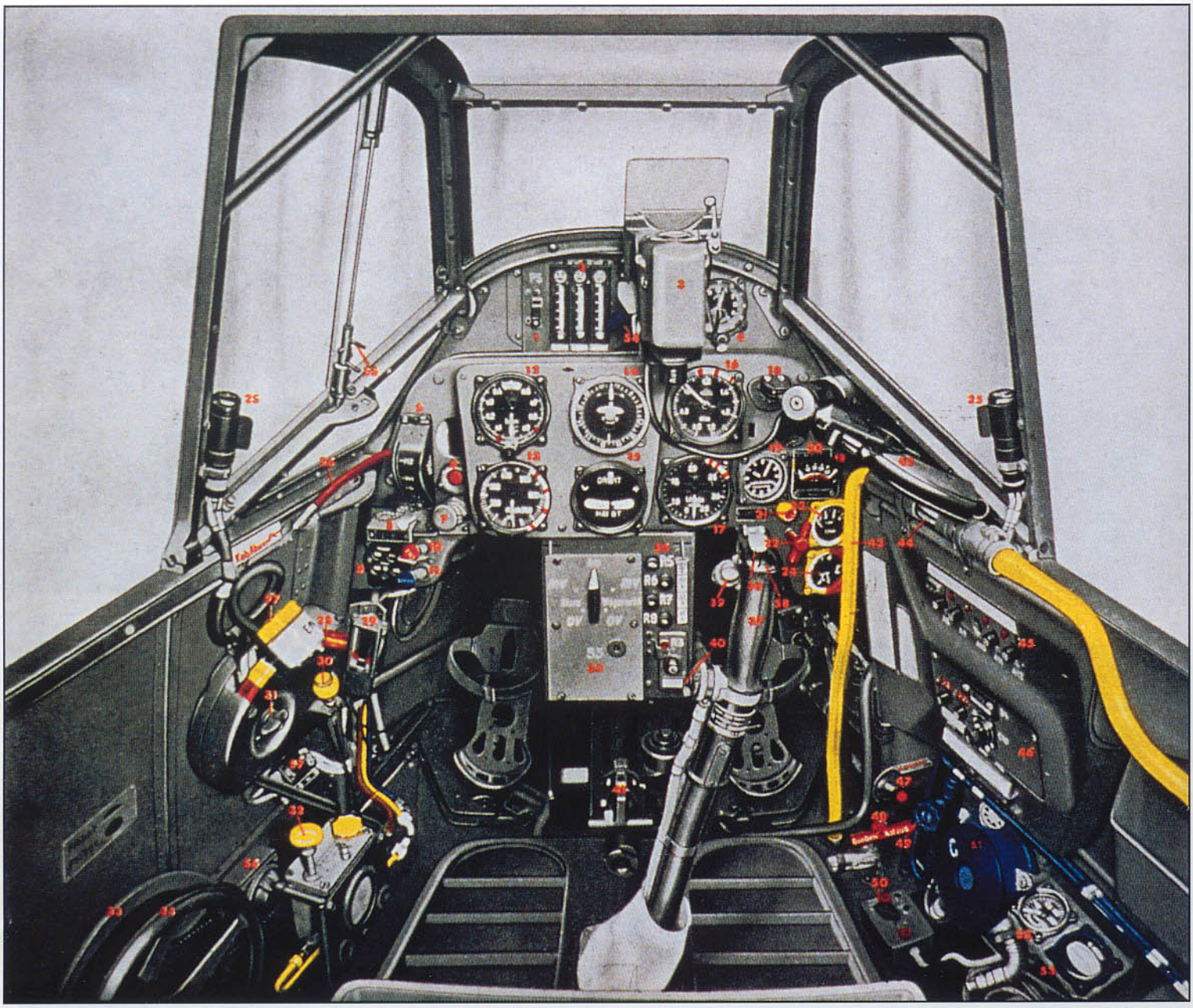
R8 – One large Rb 75/30 or Rb 50/30 aerial reconnasissance camera mounted in the rear for the fuselage just aft the fuel tank.

As will be seen in the following pages, the cockpit was essentially unchanged from the E-7 series apart from a newly designed instrument panel which featured a specially sprung secondary panel for the four main flight instruments.

Above: This Bf 109 F-2, red 1, of 7./EJG 5 is shown here during the summer of 1942. Note the supplemental bullet-resistant windscreen.

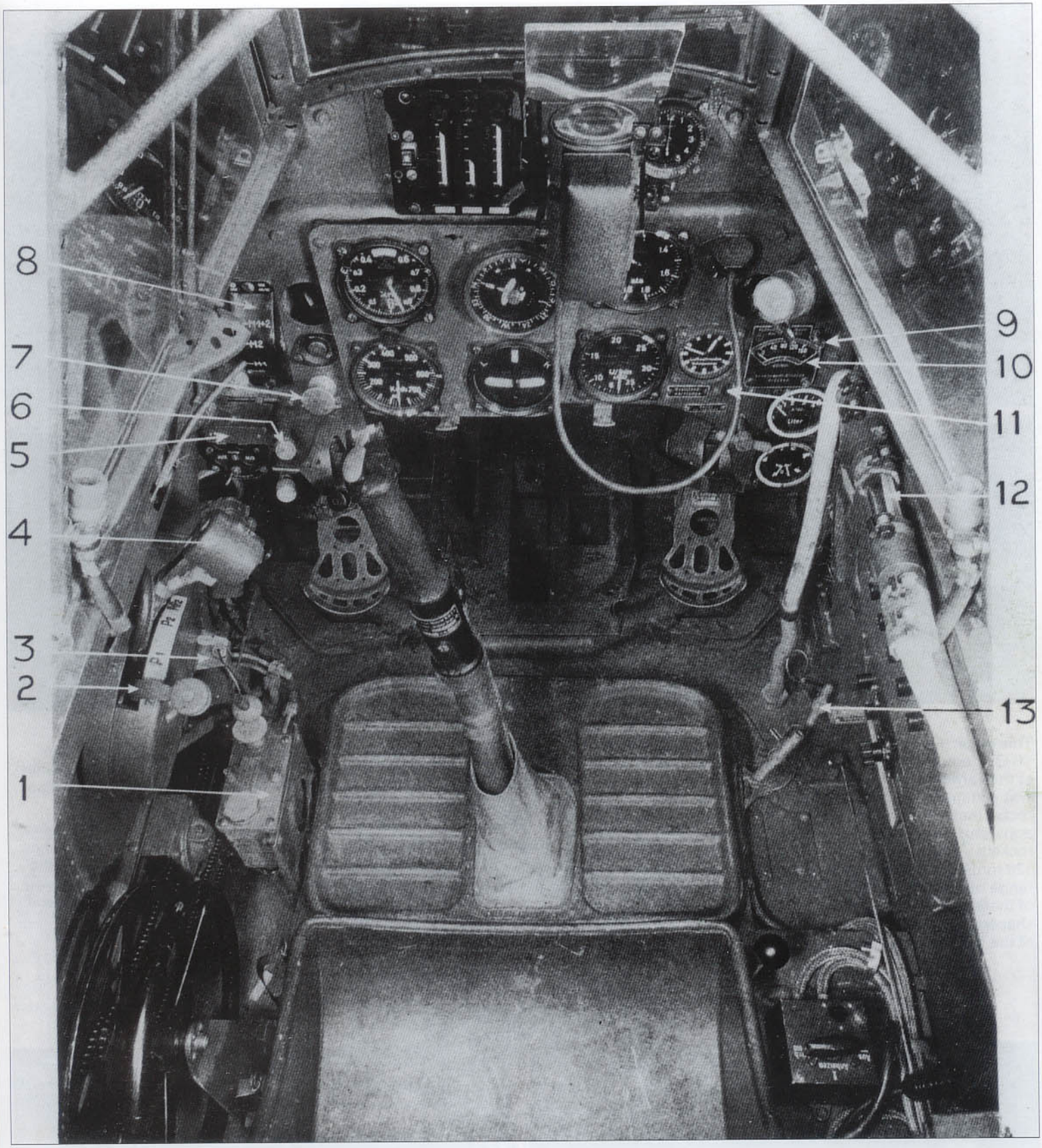


Above: A two-view of the Daimler-Benz DB 601 N which powered the Bf 109 F-2. This twelve-cylinder inverted vee liquid-cooled 33.9 litre engine had a bore and stroke of 150 x 160 mm and a compression ratio of 8.2:1 requiring C3 fuel. The supercharger was a single-stage type with a 12-bladed impeller. This 1940 engine was similar to the DB 601 A-B apart from the higher compression ratio.
Below: An interesting glimpse inside the assembly hall showing a brand new Bf 109 F-2 fuselage being checked while other workers attend to the attanchment of electrics to other DB 601 A-1 engines. A-series engines of a particular series did not usually require special identification, but other sub types frequently did. Here we see the letter "N" painted on the forward crankcase cover, shown in the upper left hand corner of this photograph. This identified the engine as a DB 601 N.



Bf 109 F-2 Cockpit

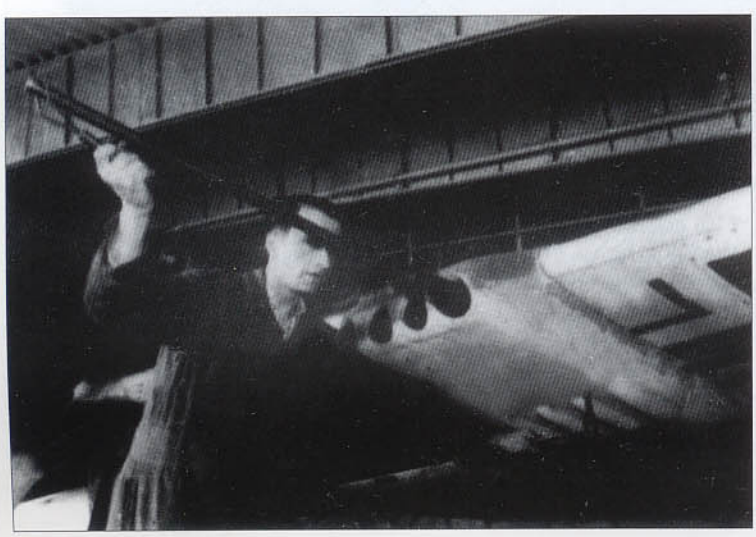
1. Master switch for arming the SZKK 3 panel
2. SZKK 3 ammunition counters
3. Revi gun sight
4. Chronometer
5. Magneto switch
6. Master switch
7. Hand lever for de-fouling the plugs
8. Starter switch
9. Undercarriage indicator
10. Landing gear up switch
11. Landing gear down switch
12. Fine and coarse altimeter
13. Airspeed indicator
14. Patin repeater compass
15. Turn and bank indicator
16. Manifold pressure gauge
18. Revi gunsight electrical plug
19. Propeller pitch indicator
20. Oil + coolant temperature gauge
21. Low fuel warning light
17. Tachometer
22. Emergency gear lowering handle
23. Fuel contents gauge
24. Fuel + oil pressure gauge
25. Instrument lighting
26. Canopy jettison lever
27. Throttle lever + attached prop pitch switch
28. Fuel shut-off lever
29. Mech. undercarriage indicator
30. Engine instant-stop lever
31. Throttle friction nut
32. Fuel system primer lever
33. Flaps control wheel
34. Tailplane incidence adjustment wheel
35. Arming fuse box for ZSK 224A (jettisonable weapons)
36. Warning lamps
37. Control column grip
38. MG 17 trigger (in safe position)
39. Bomb release button
40. Radioo button
41. MG 151/20 (without breech cover)
42. Signal flare pistol
43. Fuel inlet line from main and drop tank
44. Fuel flow sight glass
45. Radio control panel
46. Front plate to lower control panel
47. Hand grip rotary switch for coolant control
48. Emergency bomb jettison hand grip
49. Oxygen remote control valve
50. Radio switch control box
51. Oxygen economiser
52. Oxygen pressure gauge
53. Oxygen flow indicator
54. Cabin vent flap handle
55. Clear vision window locking catch
56. Tailplane incidence indicator
57. Propeller pitch change selector switch
58. Firing trigger for MG 151 cannon

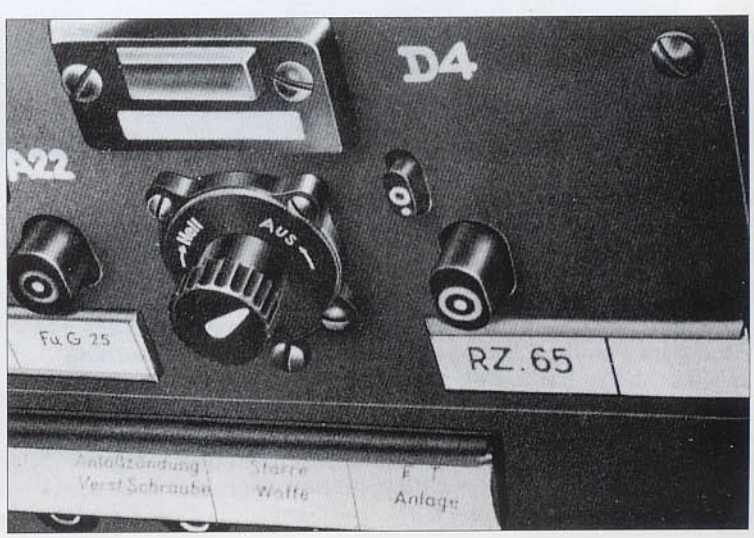


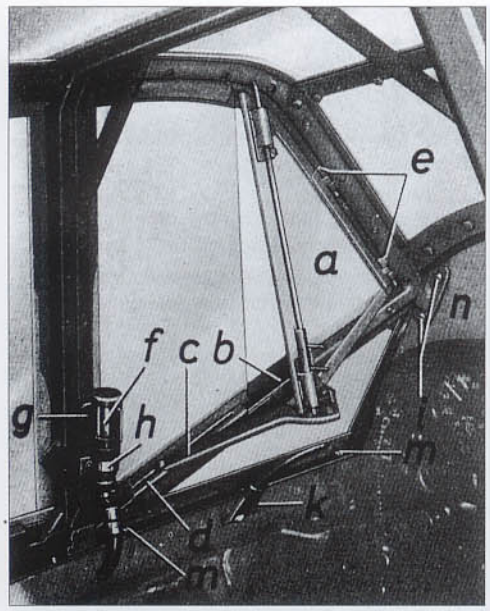
Above: A view inside the cockpit of Bf 109 F-2, W.Nr. 12764, photographed in captivity prior to its loss while being transfered from one RAF facility to another. This particular example was acquired on July 10, 1941, four months after the F-2 made its début, when its pilot, *Hptm.* Rolf Peter Pingel made an emergency landing following an engagement with returning RAF bombers. Items called-out include: (1) fuel injection pump, (2) fuel cock lever, (3) selector switch for automatic variable prop pitch, (4) throttle with propeller control, (5) starting switch, (6) switch for landing gear retraction, (7) hand grip for spark plug cleaning, (8) ignition switch, (9) propeller pitch indicator, (10) coolant exit and oil intake temperature indicator, (11) fuel warning lamp, (12) fuel flow sight glass, and (13) hand grip for coolant radiator flap control.

This page: On May 19, 1943, the Bf 109 V35, W.Nr. 9246, TH+TX, equipped with a total of eight RZ 65 rockets was tested at the Tarnewitz proving ground. This development prototype was a standard Bf 109 F-2 modified by installing two undering rocket launchers known as the 4 EG (*Einzel Geräten* - Single apparatus) under the wings, each capable of firing four RZ 65 rockets. The RZ 65, manufactured by Rheinmetall-Borsig, was a 128 mm rocket developed for air-to-air operations outside the range of normal aircraft defense systems. To control the firing of these rockets, the aircraft was equipped with a trapezoidal-shaped master control switch, located below the lower center of the instrument panel, which allowed the pilot to select one group of rockets at a time. A special fire control switch was positioned on the right side of the cockpit, shown below, while the actual firing of rockets was accomplished by depressing a firing button to the left side of the control column head.

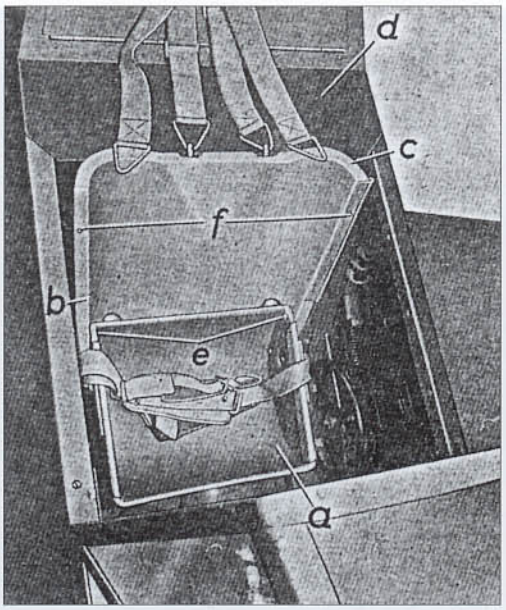
The photograph to the lower left shows the long shaft needed to charge the rockets once they had been seated in their tubes. Although it was planned to make the system available for the Bf 109 F-2 and F-4 series as *Rüstsatze 6* (R6), tests at Tarnewitz revealed the rockets had unfavorable flight charateristics, and the plan was dropped.



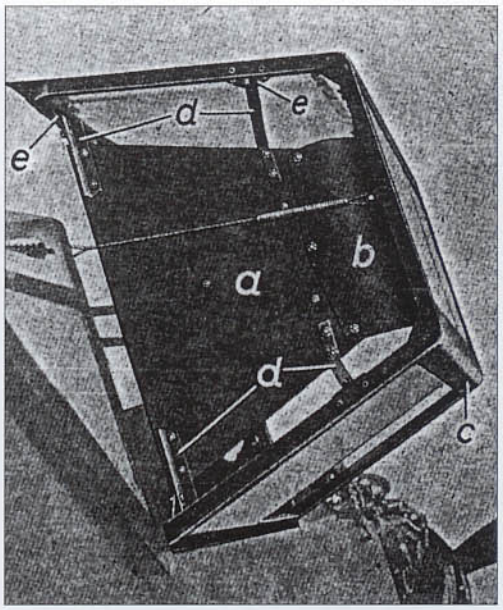




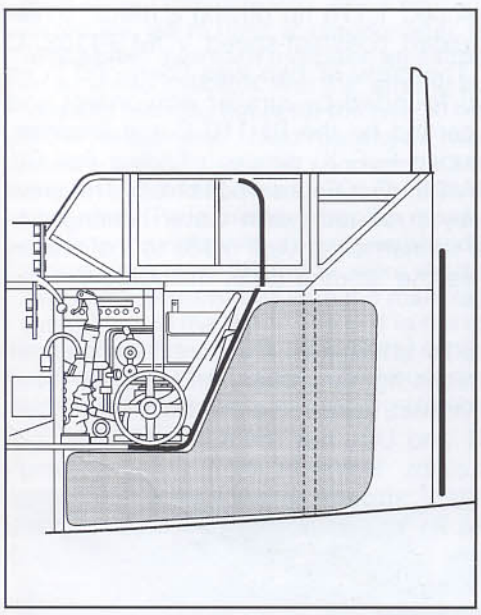
A close-up of the inside adjustable side pane to the forward windscreen. This design allowed the pilot to open the forward portion of the panel in one of several settings for cockpit ventilation. This basic arrangement was a standard feature of all Bf 109s up to and including the F-series including the T-series(see p. 100). The lower, triangular-shaped, pane was fixed and was another early design feature to improve instrument panel illumination.



A top view of the pilot's seat showing the various straps and belts. The base of the seat is curved to conform to the shape of the pilot's parachute which also doubled as a seat cushion. In this view, the center and rear sections to the canopy, which normally would have obscured the layout, have been removed from the airframe for clarity.

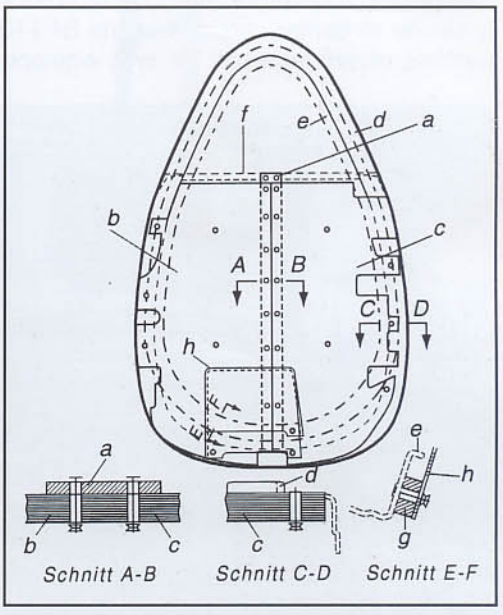


The heavy one-piece canopy center section was hinged to starboard and contained the 8 mm shoulder and head armor fastened to the canopy's framing. Although this substantially restricted rearward vision, it was felt essential for pilot survival. This entire section, as well as the smaller rear canopy, could be quickly jettisoned in an emergency.

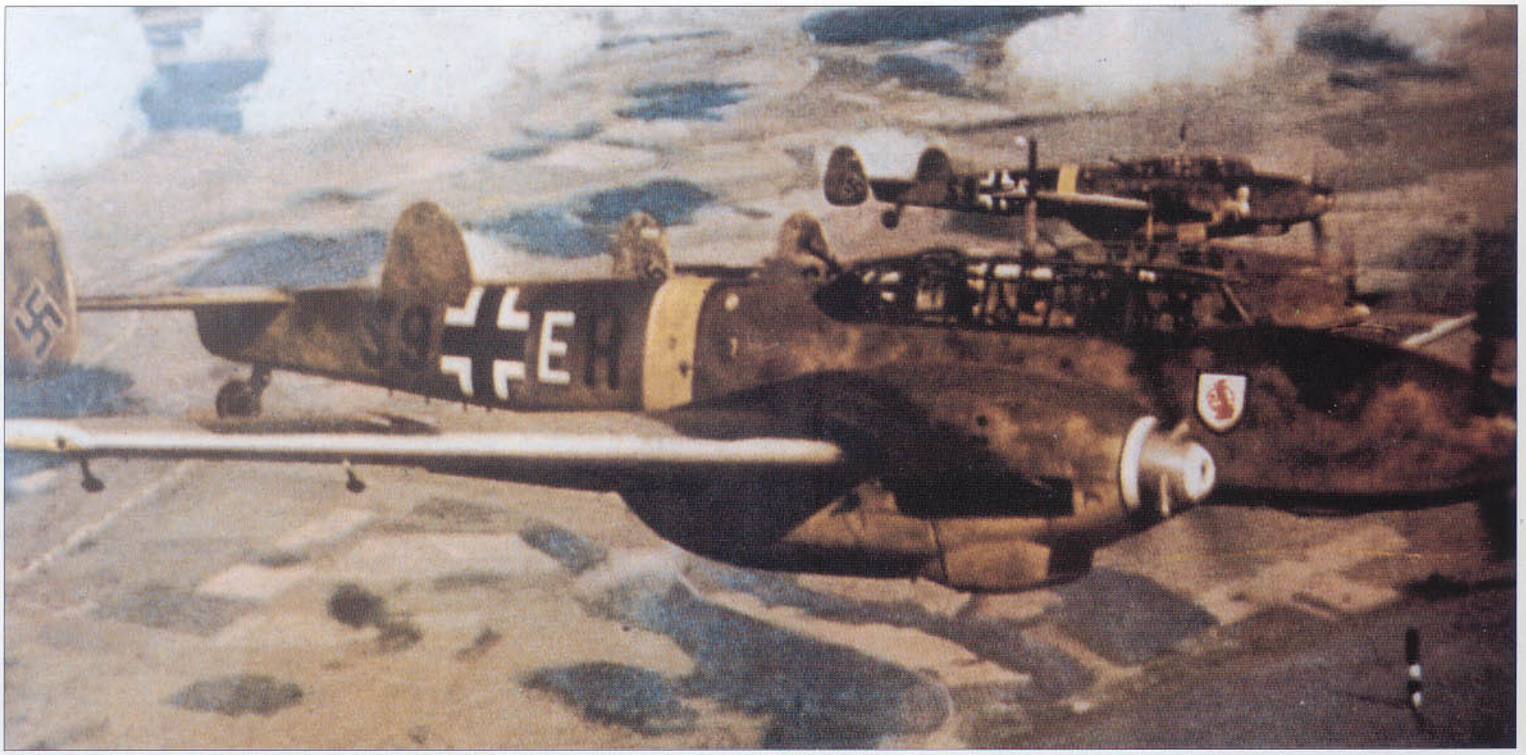


Schematic view of the cockpit showing the L-shaped fuel and under the pilot's seat. The pilot's armor consisted of steel plates formed under and to the back of his seat in addition to the shoulder and head armor described above right. The laminated armor plate for the fuel tank is shown immediately aft of the tank itself.

Maj. Hannes Trautloft, Kommodore of JG 54 "Green hearts", in the cockpit of his Bf 109 F-2. The yellow and white triangle beneath the cockpit is just below the fuel tank's filler point. Within the triangle is the code C-3 which refers to aviation fuel of 96 to 100 octane.

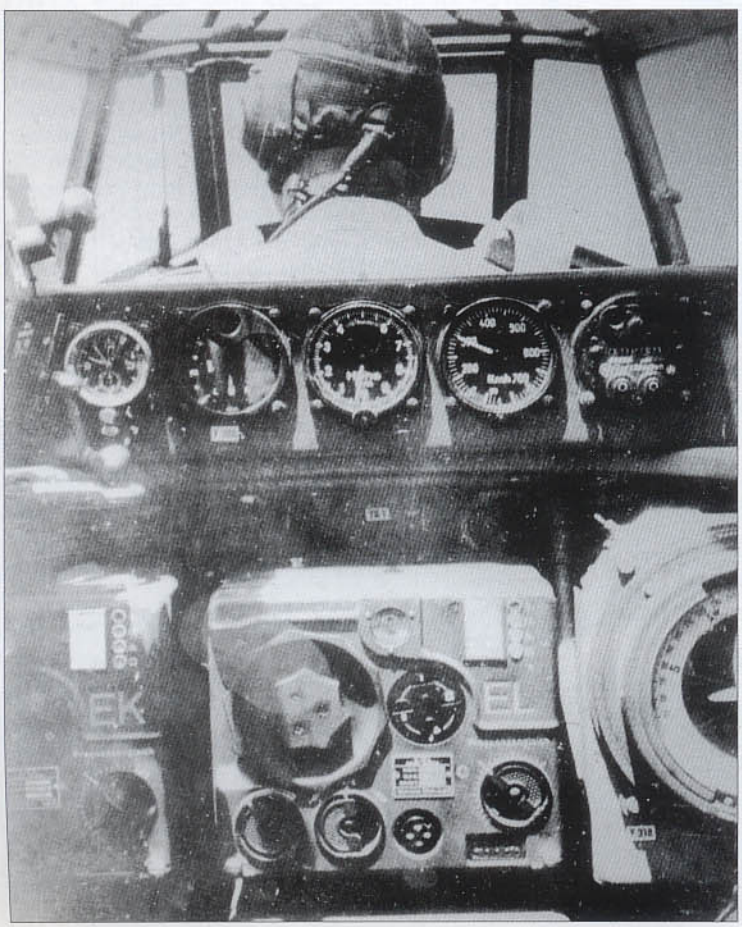


Fuselage sectional drawing showing the location at fuselage frame three and attachment points for the fuel tank's armor. The armor consisted of two plates, split down the middle vertically, and consisted of multi-laminations of sheet steel in place of the more common practice of one-piece armor plates.



Messerschmitt Bf 110 E-1

Like the Messerschmitt Bf 109 E-7/N, the Bf 110 E-1, which appeared in May 1941, was powered by two DB 601 N engines and was equipped with a standard fixed-armament of four MG 17s above and two MG FF/Ms below the nose. Additionally, a single MG 15 hand-held machine gun was mounted in the rear of the cockpit. This series was essentially similar to earlier versions of the Bf 110, but incorporated a number of refinements. It was equipped with four ETC 50 bomb racks mounted beneath the outer wing panels next to the engine nacelles which were capable of carrying four 110 lb bombs. When not carrying bombs, it could be fitted with two 300 litre (79 gal) drop tanks beneath the outer wing panels for extended range duties.



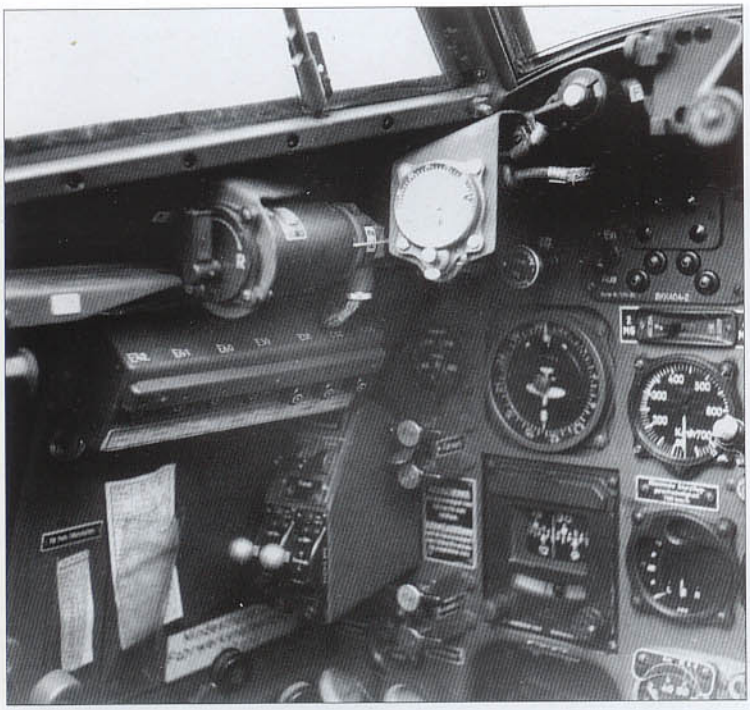
Each DB 601 N developed 1,175 hp driving a metal, three-bladed, electrically actuated, constant-speed, VDM 9-11081-C automatic propeller. The crew of two was contained in an elongated cockpit surrounded by similar equipment and instruments as was carried by the Bf 110 C and D-series. Radio equipment included FuG X, direction finding Peil GV, plus Fu Be 1 and Ei V4 (FuG XXY also possible). The crew could be kept warm by a refined warm water heating system, and certain other refinements were made to the oxygen installation, as well as the landing gear, including the tail wheel leg.

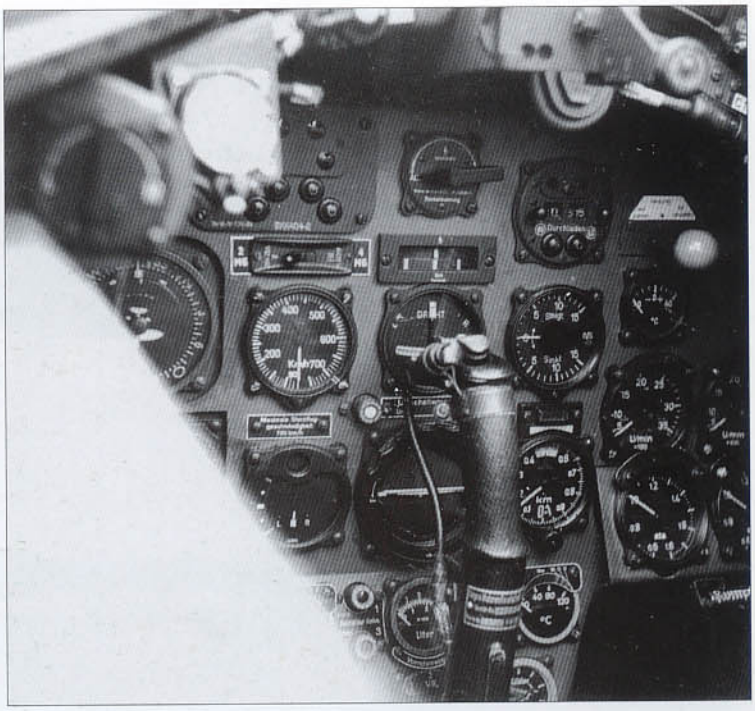
Reportedly, Bf 110 E-1s fitted with the so-called Spanner infra-red sensor for night fighter duties, and aircraft fitted with an additional crew seat, received a modification to their designation (resp. U1 and U2), but there is no official evidence to support this claim. However, the E-series was eligible for various auxiliary apparatus packages (known as *Rüstsätze*) such as the R1 kit comprising two under-fuselage ETC 1000 racks capable of carrying a pair of 2,205 lb. (1,000 kg) bombs when the wing racks were deleted.

The Bf 110 E-1 was produced in some numbers and saw action at almost every front to which the *Luftwaffe* was committed.

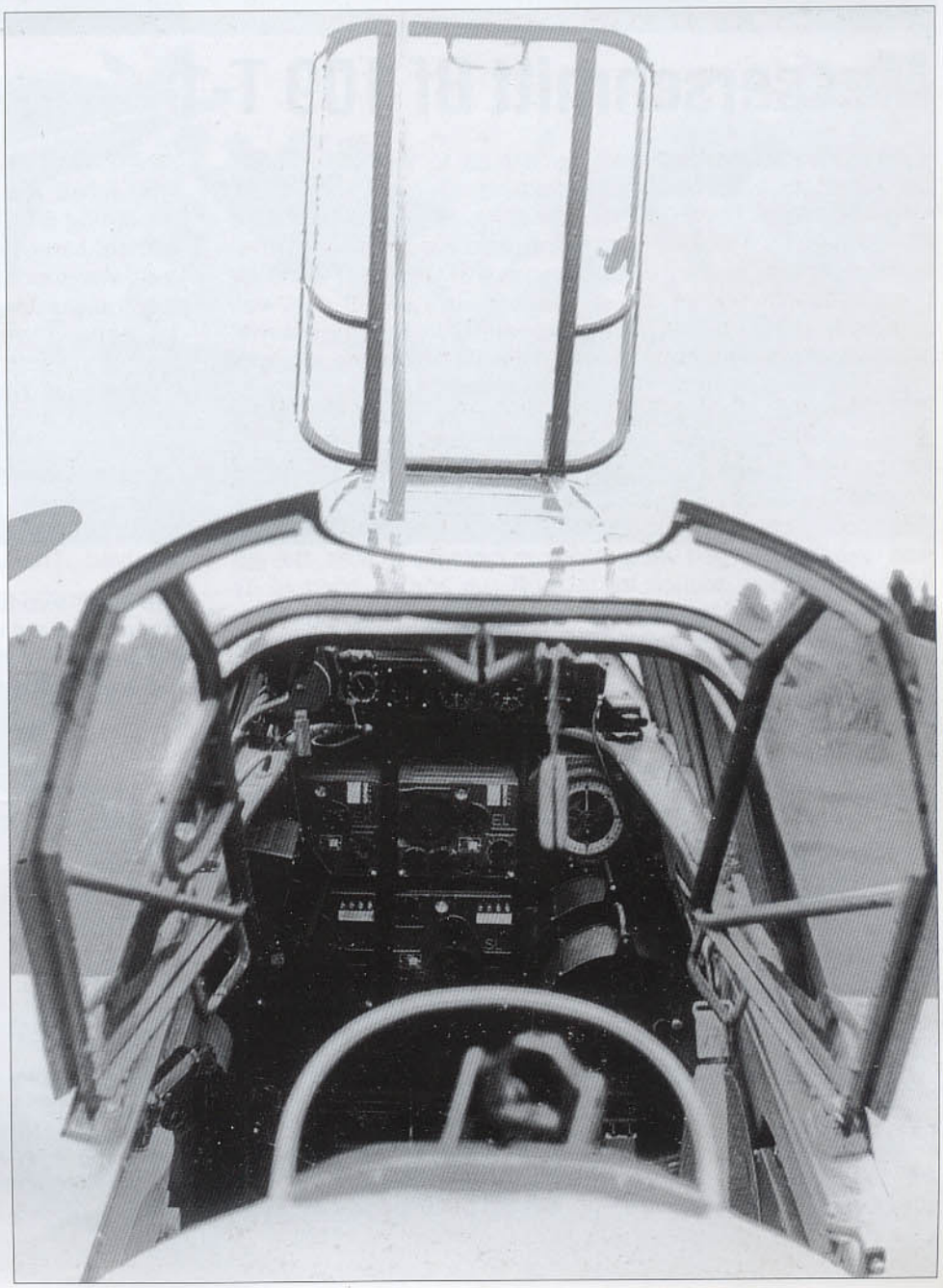
Above: Two Bf 110 E-1s of 1./ZG 1, in flight with the nearer aircraft coded S9+EH. The deepened radiator was a characteristic of late production E-1s powered by the DB 601 N-1.

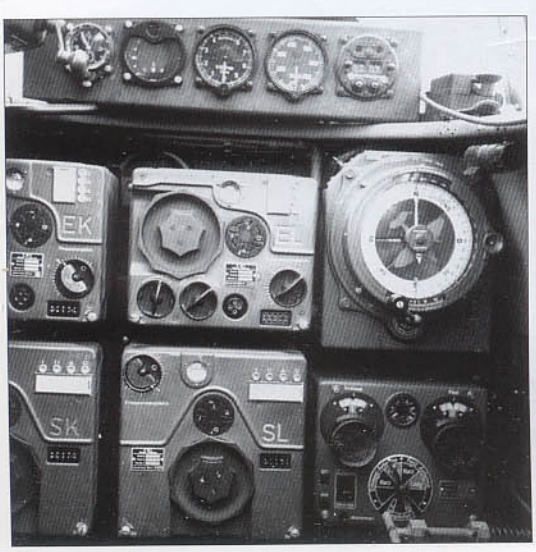
Left: Looking forward from the observer's position. The handle with the round knob on the left of the photograph is part of the remote control unit of the direction-finding system.

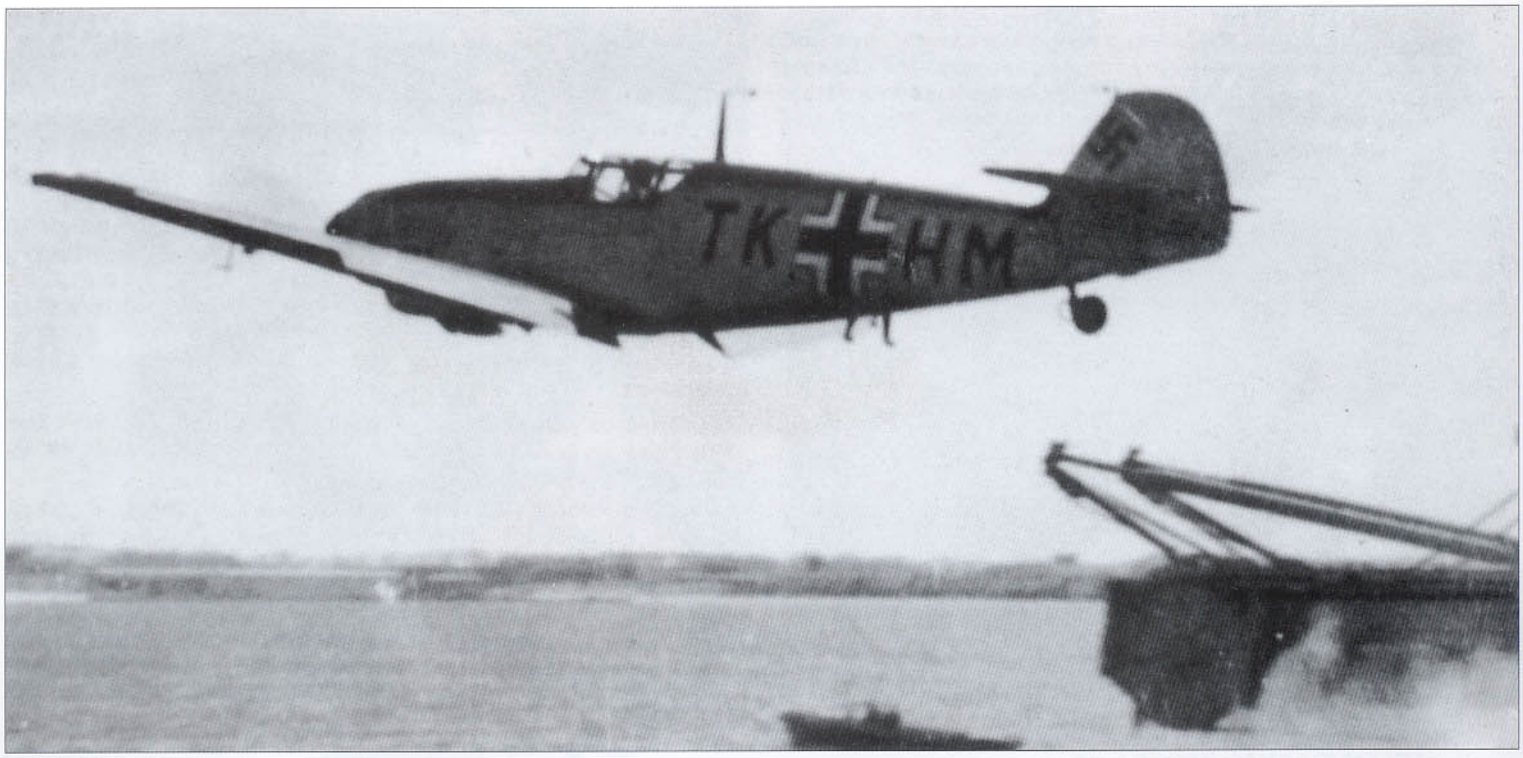




All photographs on this page show interior details of Bf 110 E-1, W.Nr. 4114, SJ+KB, operationally coded LN+FR, which was on strength with 1.(Z) JG 77 based at Rovaniemi, Finland. This aircraft, piloted by *Lt.* Felix Brandis, landed by error at Tärendö, Sweden on September 1, 1941 after making a navagational error. **Above:** Two close-up views of the main instrument panel. **Right:** A view of the rear gunner's position looking forward. **Below:** Close-up of instruments and equipment shown opposite left. The 5 instruments on top are, left to right, a chronometer, the AFN-2 blind approach indicator, an altimeter, an air speed indicator, and the arming buttons and warning lights for the two 20 mm MG FF/M cannons. Next row shows two receiver units. EK was for short range 3-6 megacycles and EL was long range 300-600 kilocycles. Patin master compass repeater dial is to the right with its superimposed loop bearing indicator. SK and SL were short and long range transmitters with the main radio control box to the right. The dial in the top left corner of this box is the trailing aerial tuning control; in the middle is the frequency meter with the tuning range indicator on the right for the fixed antenna.







Messerschmitt Bf 109 T-1

Germany's interest in aircraft carriers up to the Third Reich, had never played a role in *Kreigsmarine* (German Navy) planning. However, by 1936 the Hitler government backed a naval plan to build at least one carrier. Work on this, Germany's first aircraft carrier, began in December 1936 by the Deutsche Werke, and on December 8, 1938 she was launched at Kiel as the Graf Zeppelin. In the meantime, Messerschmitt had been approached to determine if his Bf 109 could be adapted to carrier operations. To test the concept, three Bf 109 prototypes were initially dedicated to the navalised fighter. These included the Bf 109 V15, V16 and the Bf 109 V17. These prototypes incorporated various features intended for carrier duties such as an arrester hook and catapult spools, but the main characteristic of the navalised version was the enlarged wing. With an increase in area, the aircraft was able to reduce its take-off run and to improve its stability during the landing approach. Both of these qualities were essential for carrier operations. In addition to these aircraft, several additional machines participated in the development program which extended through 1939 and into the first half of 1940.

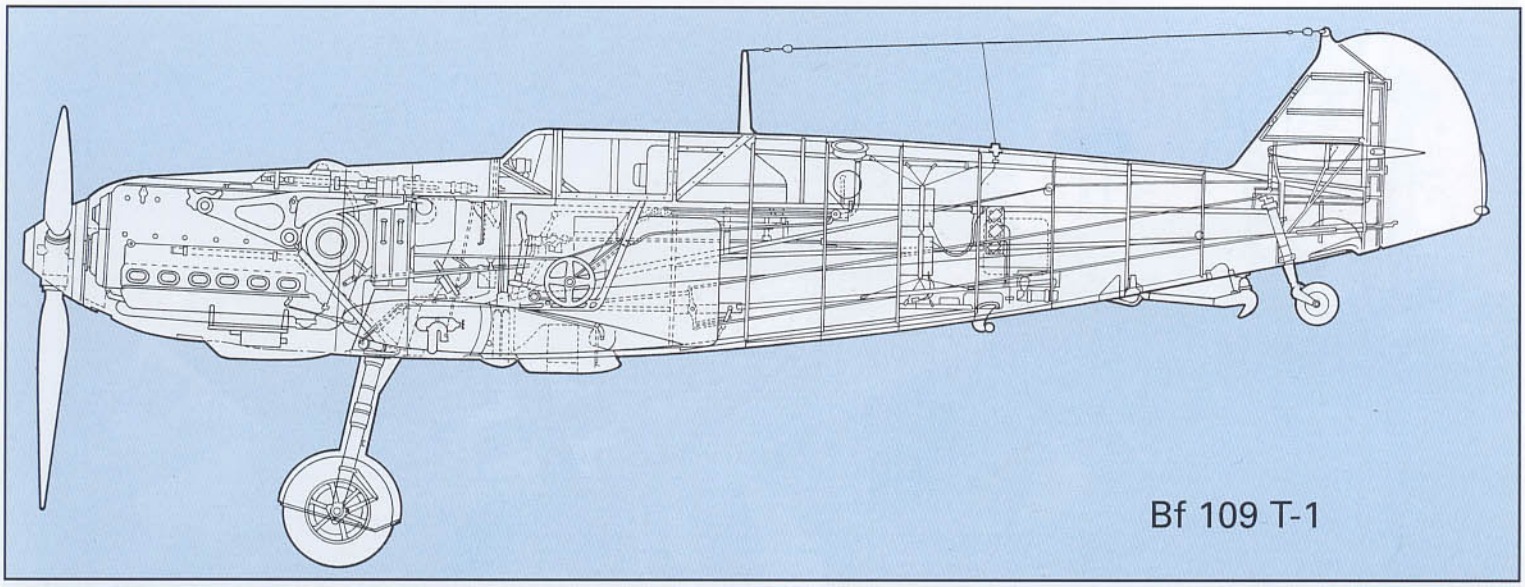
The fully navalised production version, the Bf 109 T-1 (T for *Träger*/Carrier), was similar to the Bf 109 E-4/N, powered by a DB 601 N driving a metal, three-bladed, VDM 9-11081C propeller. It also featured extended wings with spoilers (but without the folding capability), and modifications to the fuselage including catapult spools, fuselage protectors and an arresting hook. These aircraft were also equipped with GM 1 powerboost equipment and a tailwheel locking device. In most other respects these aircraft were similar to the standard Bf 109 E-4 series including the layout and instrumentation of the cockpit.

Production was entrusted to the Fieseler Werke of Kassel who produced seven fully-equipped carrier fighters up to mid 1940. At this time, the German government decided to halt all further work on the Graf Zeppelin which was no longer considered necessary to the war effort. Simultaneously, work on the second carrier, the Peter Strasser, was also stopped.

When work on the Graf Zeppelin was halted, Fieseler was instructed to stop work on the T-1 and to complete the remaining 63 aircraft of the contract as land-based fighters without carrier equipment. Designated Bf 109 T-2, these aircraft were extensively flown up to early 1942. At that time the survivors were returned to Fieseler and retro-fitted as T-1s since it was anticipated that fitting- out of the Graf Zeppelin would shortly be reinstated. Thirty days after work on the Graf Zeppelin had resumed, it was once again canceled and with it all hope of seeing the Bf 109 T-1 fly from her deck. After this final cancellation, the remaining T-1 fighters, were reconverted back to land-based Bf 109 T-2s. These aircraft (approximately 50) were delivered to I./JG 77 based at Drontheim, Norway where they were enthuastically received. This unit was redesignated I./JG 5 in January 1942.

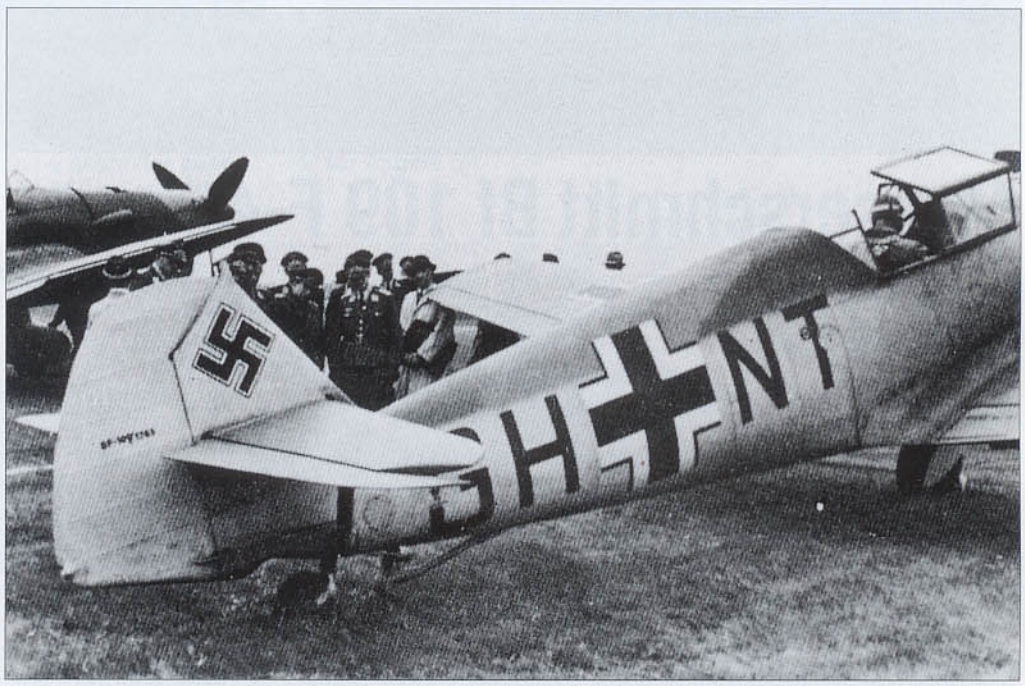
The extensive testing and development program carried on at Travemünde and Berlin-Johannisthal yielding considerable experience in the world of carrier-operated aircraft which, in the end, was never put to the test.

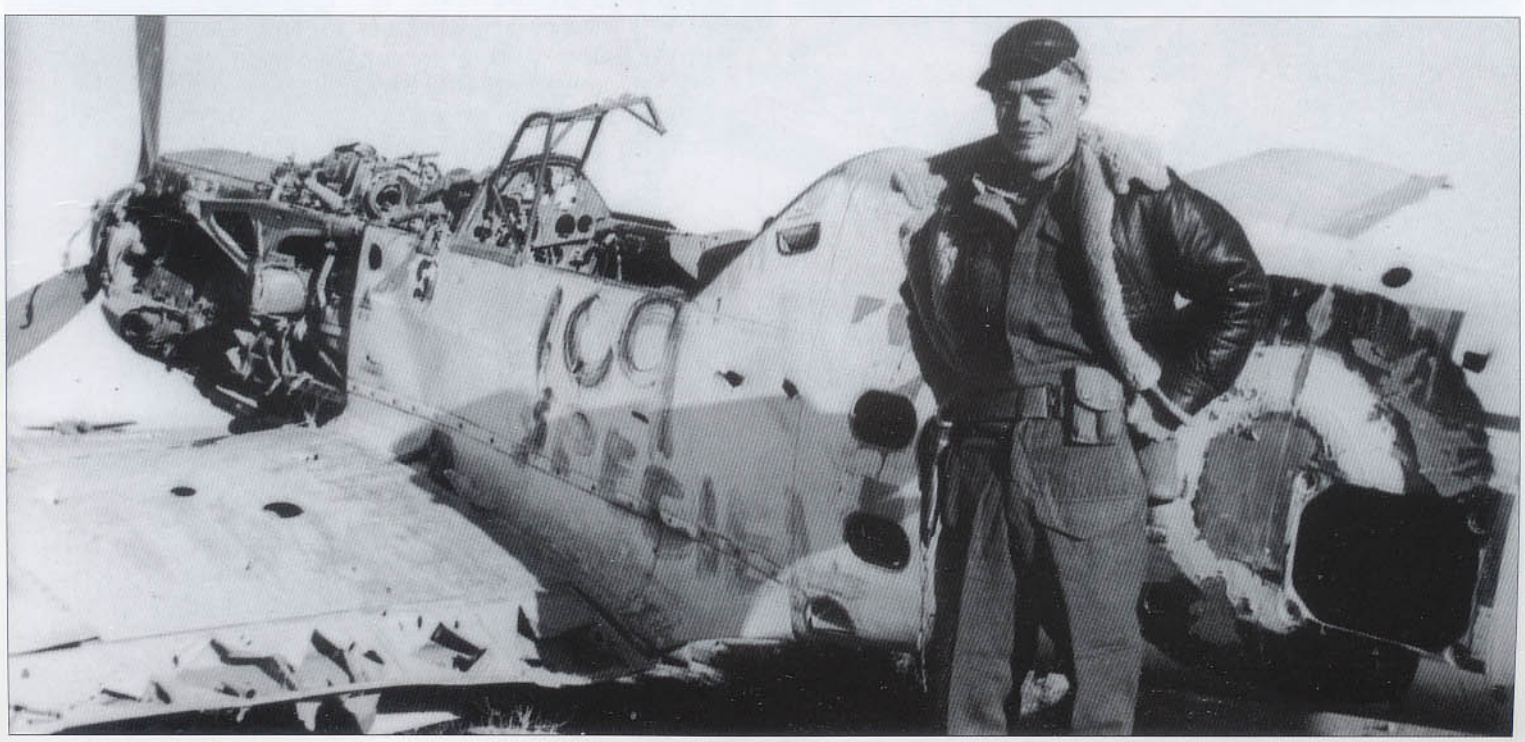
Above: Bf 109 V17, W.Nr.1776, ex D-IKAC, TK+HM, is shown at the instant it left the land-based catapult while undergoing tests at Travemünde on the Baltic Sea coast. The two small probes extending from the lower rear fuselage were installed to protect the aircraft at launch from the elastic belts of the catapult system. Note that during these tests, the required arrester hook was not fitted. The V17 was completed in February 1938 powered by a Jumo 210 G engine.



Right: On August 23, 1940, Bf 109 E-4/U, W.Nr. 1783, GH+NT, was demonstrated before visiting Ernst Udet and other dignitaries of the Air Ministry. This T-series development aircraft was equipped with an arresting hook and aft-facing wing tip formation lights, both features intended for the Bf 109 T-1.

Below: An American officer posing next to the derelict remains of a Bf 109 T-2 crudely marked with British national aircraft insignia. This view shows several interesting features unique to the T-series including the extended supercharger intake and dual starboard fuselage access hatches for GM 1 powerboosting equipment. The T-2 resulted when the decision was made to convert all T-1s to land-based fighters without carrier equipment. The small unit insignia below and forward of the cockpit belonged to JG 26, but it is unclear if this Bf 109 T-2 was ever attached to this well known unit.





Messerschmitt Bf 109 F-4

The Bf 109 F-4 first appeared in June 1941, powered by the new DB 601 E driving a metal, three-bladed VDM 9-12010A propeller. It was similar to the F-2 series, but armed with the new 20 mm MG 151/20 engine-mounted cannon. The FuG 7a radio was now standard and an improved self-sealing fuel tank was installed. The pilot was afforded greater protection by the addition of 5 mm curved shoulder and head armor-plate attached to the moveable canopy. The Revi C/12D gun-sight was standard. Many examples of the F-4 were also retro-fitted with an armored windscreen. This feature, with its thick glass (57 mm - 2¼ in.) somewhat restricted forward view, but the added frontal protection was welcomed by most pilots.

A number of auxiliary equipment items could be carried by the F-4 series (and were also applicable to the F-2 series). These included:

R1 – ETC 500/IXb bomb rack mounted beneath the fuselage.

R2 – 4 x ETC 50 VIId bomb racks beneath the fuselage.

R3 – 1 x 300 ltr. (79 gal.) drop tank mounted under the fuselage.

R4 – Adapter for up to eight small bombs under the fuselage.

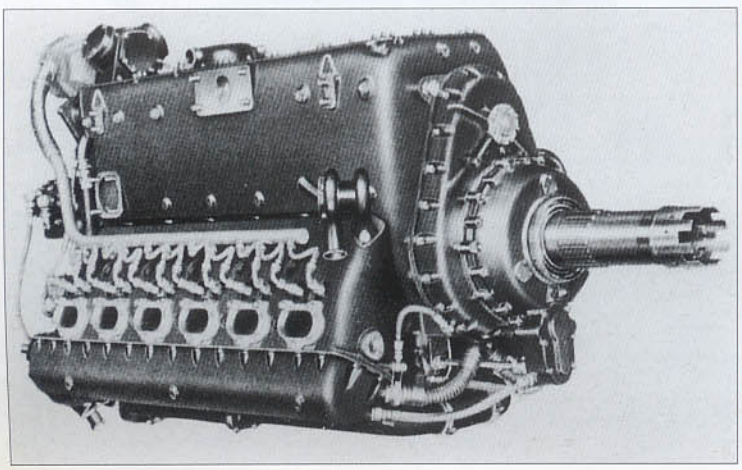
R5 – 1 x Rb 20/30 reconnaissance camera.

R6 – EGRZ 65 underwing rocket installation.

R7 – 2 x MG 151/20 underwing cannons.

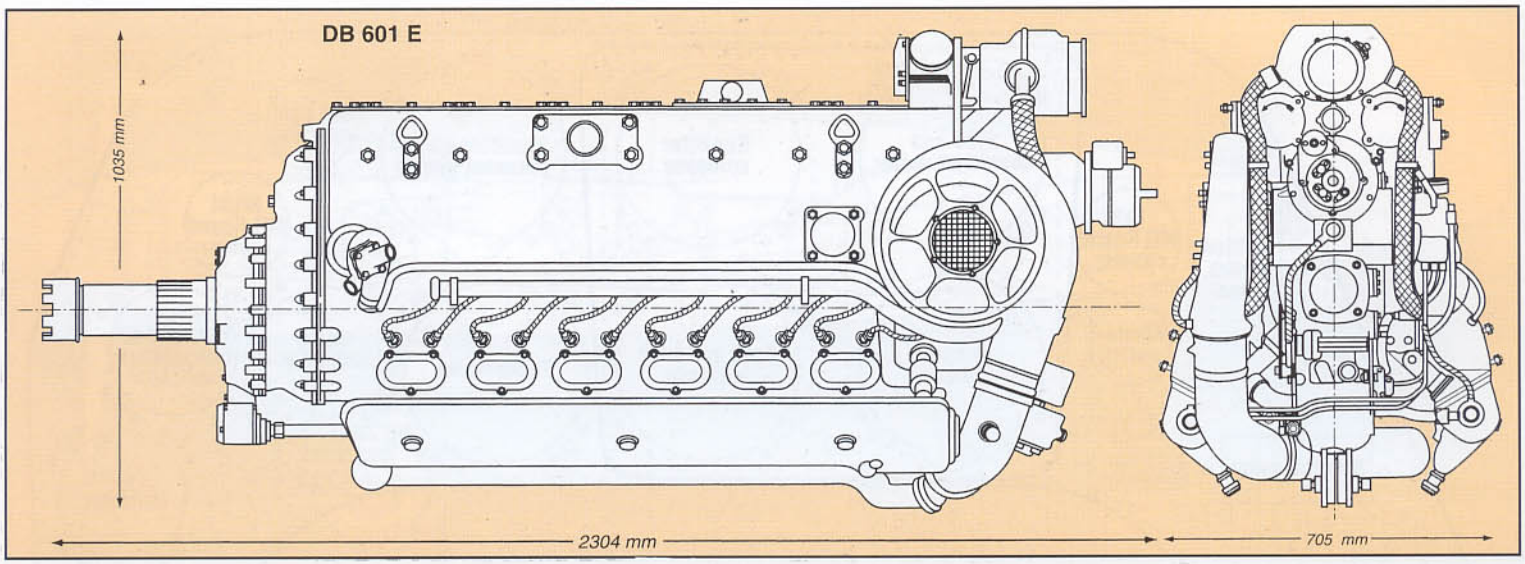
R8 – 1 x Rb 75/30 or Rb 50/30 aerial reconnaissance camera.

In addition to the above items, a small number of Bf 109 F-4s were adapted to take powerboosting equipment known as GM. This system utilized the injection of nitrous-oxide into the supercharger to increase power of the engine above the rated altitude (see page 90). Aircraft fitted with GM1 were designated Bf 109 F-4/Z (Z - *Zusatzgerät*/supplemental device). The operational career of the F-4 spanned barely 12 months before this variant was replaced on the production line by the more powerful Bf 109 G-series. Many surviving F-4s were then transferred to the various fighter training schools.

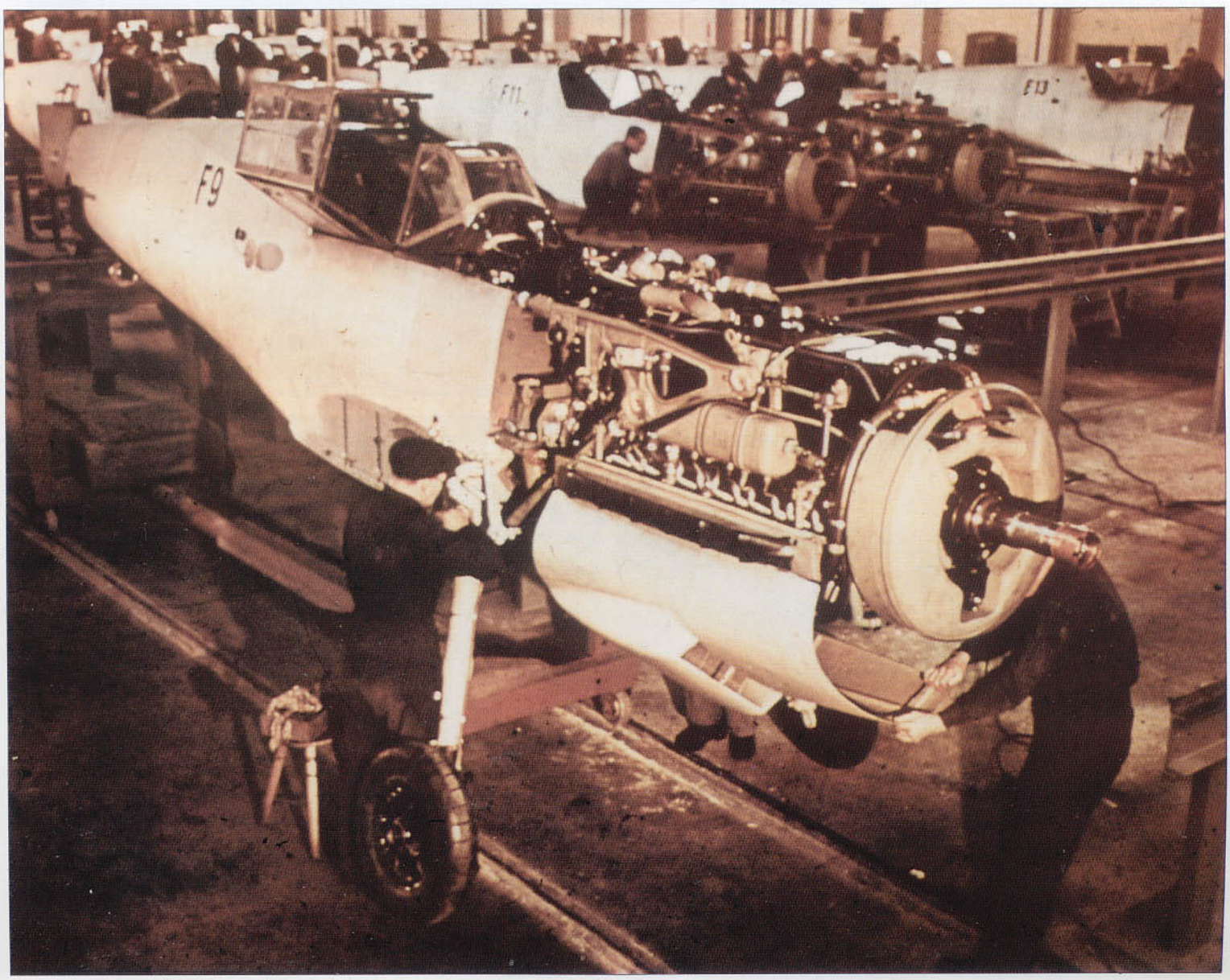


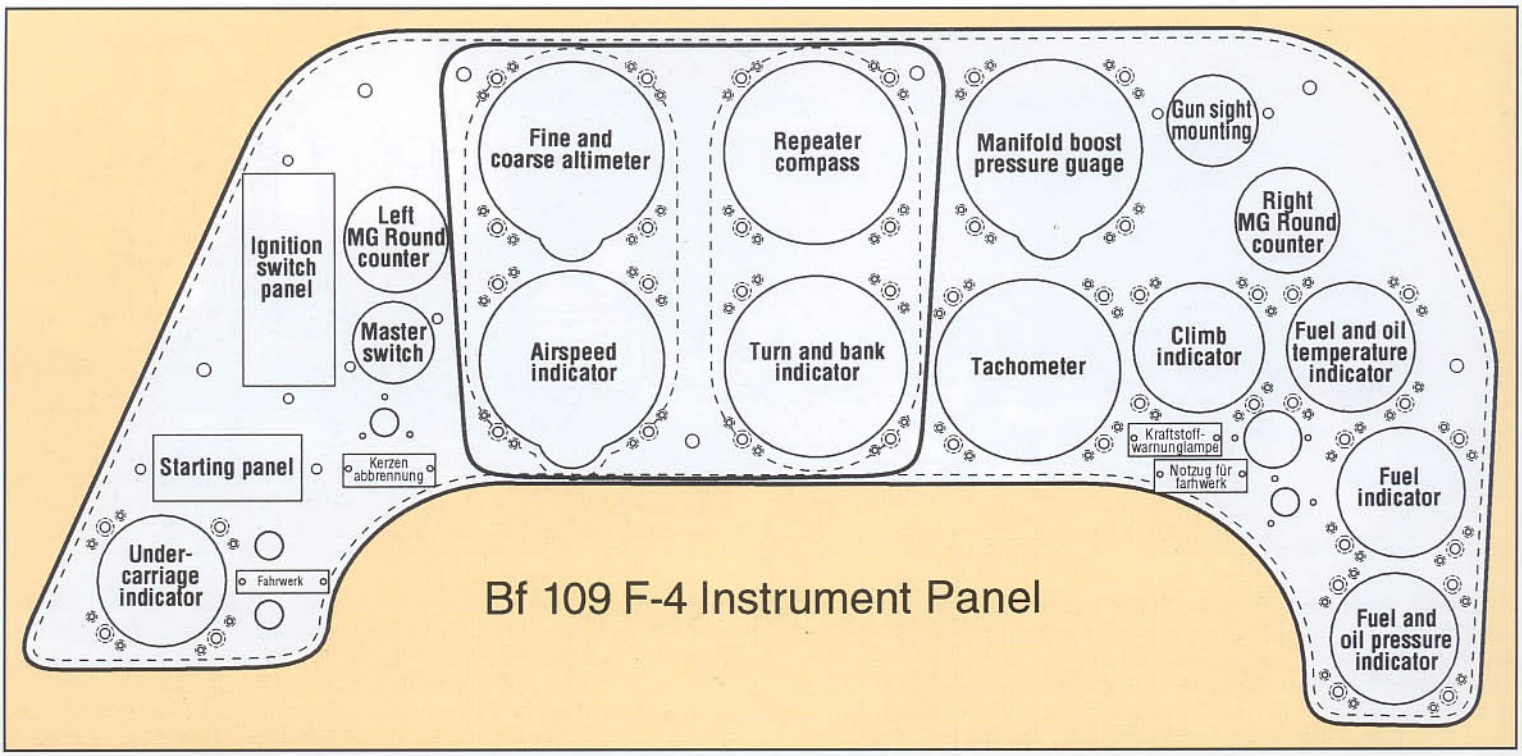
Above: This Bf 109 F-4, VE+TU, photographed in May 1942, was armed with two MG 17 machine guns and one MG 151/20 cannon, and first appeared during June, 1941. It was an immediate success and was flown on all fronts where the *Luftwaffe* was committed.

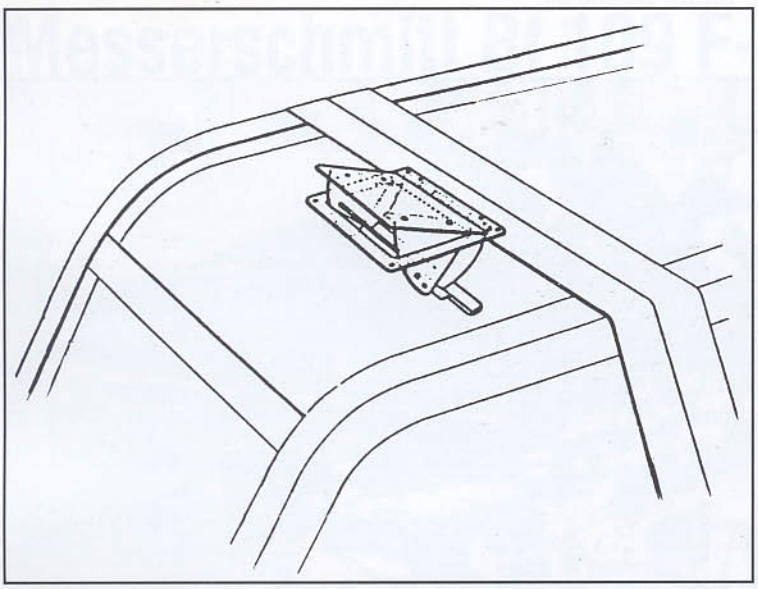
Left: An overall view of the starboard side of a DB 601 E which powered the F-4 series. This engine developed 1,350 hp for take off at 2,700 rpm.



Above: A two-view of the Daimler-Benz DB 601 E which powered the Bf 109 F-4. This was a twelve-cylinder inverted vee liquid-cooled 33.9 litre engine with a bore and stroke of 150x 160 mm and a compression ratio of 7.0/7.2 requiring B4 fuel. The supercharger was a single-stage type witha twelve-bladed impeller. This 1940 engine was based on the DB 601 A,but incorporated a number of changes including new propeller gear reduction and housing. This engine delivered 1,350 hp at 2,700 rpm for take-off and emergency power. **Below:** A view inside the Wiener-Neustadter Flugzeugwerk (WNF) assembly hall, south of Vienna, showing Bf 109 F-4s nearing completion. WNF was the largest single producer of the Bf 109. The workman in this photograph is holding the one-piece lower cowling which was hinged on the right side and incorporated the radiator for engine oil.





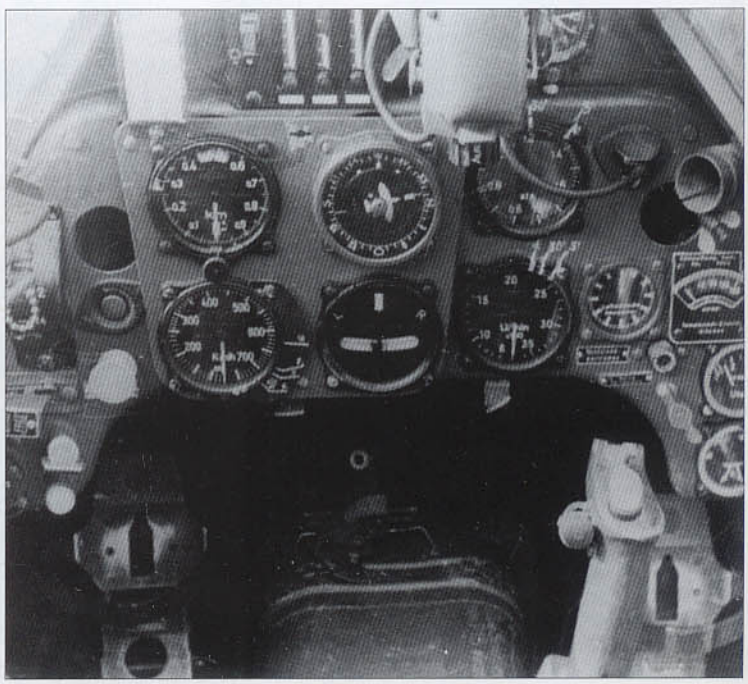


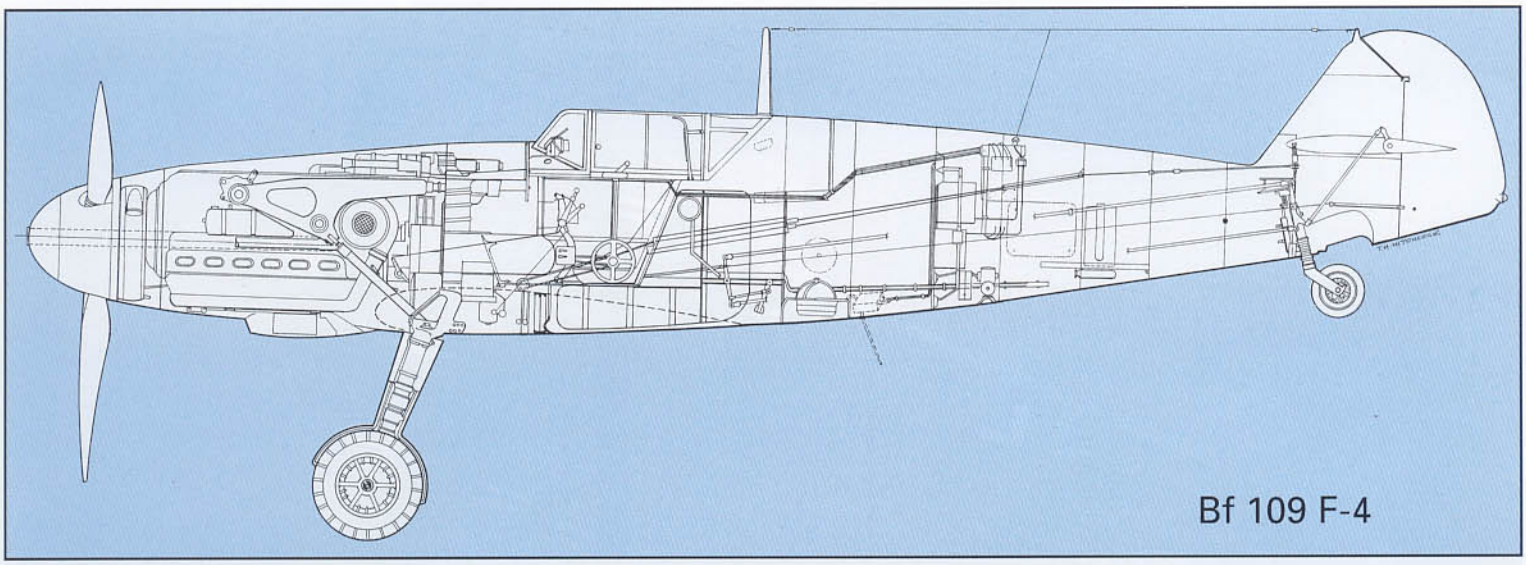
Above: The instrument panel for the Bf 109 F-4, which was identical to the F-2, featured two independent parts. The center section, slight off-set to the left, was reserved for flight instruments.

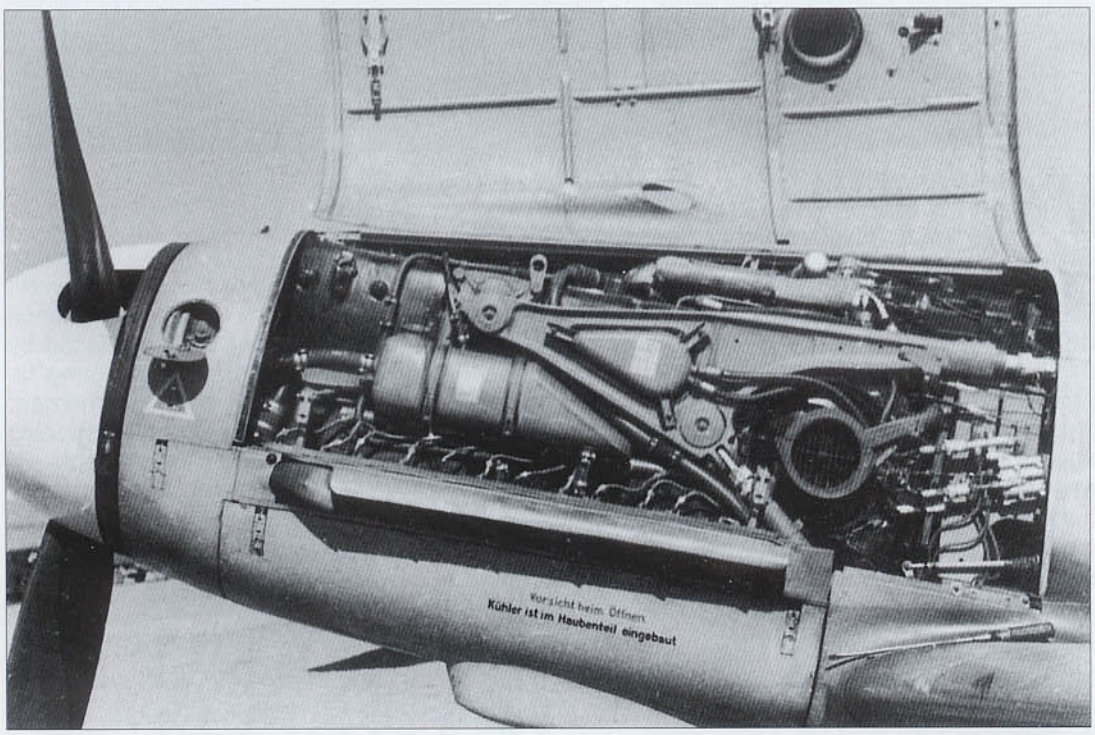
Left: A sketch of the adjustable cockpit ventilation hatch located at the top of the forward windscreen for the Bf 109 F-4/trop.

Lower left: A close-up of right side of the canopy of a Bf 109 F-4/trop showing the auxiliary bullet-resistant 57 mm windscreen.

Below: A glimpse inside the cockpit of a Bf 109 F-4 showing the large cover for the engine-mounted 20 mm cannon in the lower center.

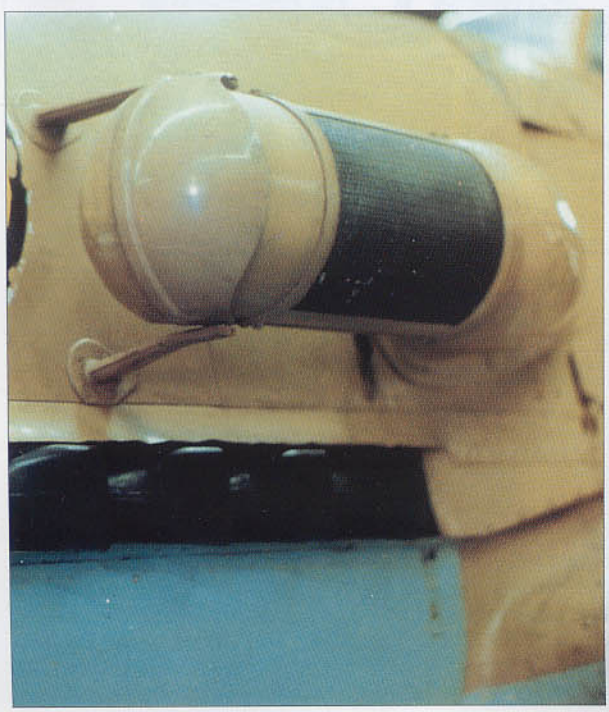


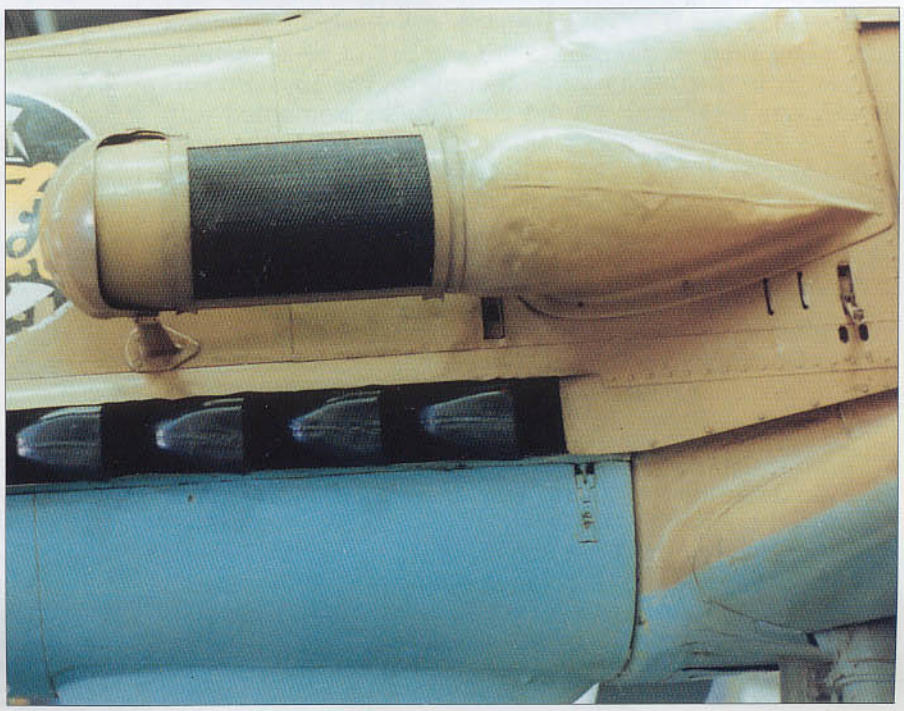




Left: A Bf 109 F-4/trop with its port cowl opened to reveal a compact and functional engine bay.

Below: Two views of the Italian-designed sand filter adapted to the Bf 109 F and G- series. It used a simple two-part clam shell baffle at the front, which was opened by the pilot via a long cable extending to the lower left corner of the instrument panel. While on the ground, the baffle remained in the closed position, directing air to the engine by way of the fine mesh screen. The baffle was opened after the aircraft was clear of ground sand and dust.





Focke-Wulf Fw 190 A-1

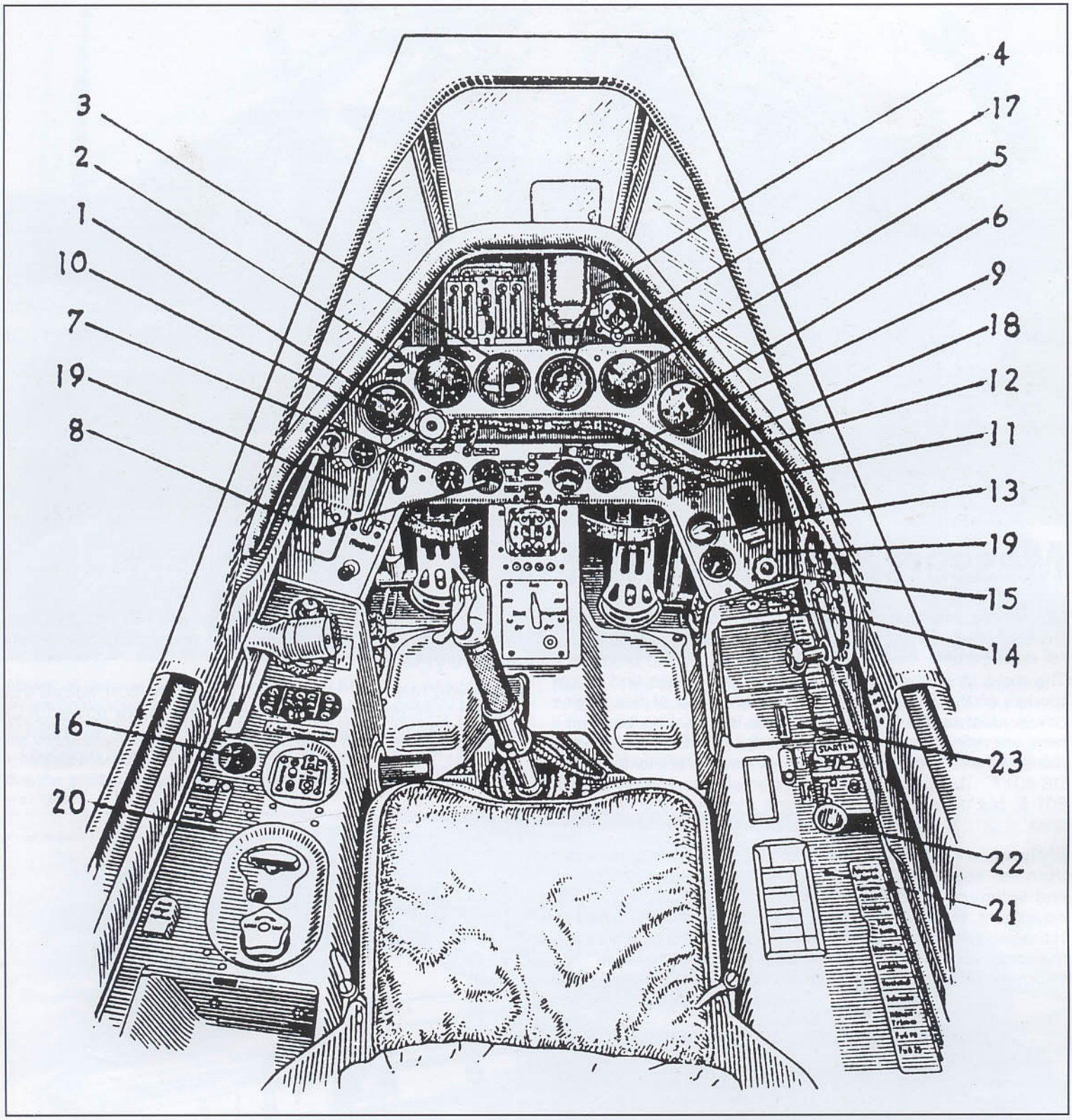
The first production model, the Fw 190 A-1, appeared in June 1941, at the same time the Luftwaffe was taking delivery of the new Bf 109 F-4. Development prototype for the A-1 series was the Fw 190 V7, W.Nr. 001, which was first flown during February 1941. The early aircraft of the Fw 190 A-series had their share of development and acceptance problems, which nearly forced the cancellation of the whole Fw 190 program. However, by the time the last of the initial batch of 102 production aircraft had been completed by Focke-Wulf's Marienburg in January 1942, many of the major objections had been corrected.

Powered by a BMW 801 C-1 air-cooled radial engine driving a metal, three-bladed VDM 9-12067B propeller, the Fw 190 A-1 was armed with four MG 17 machine guns (two each in the top cowling and wing roots), plus two MG FF cannon just outboard of the landing gear to fire outside the propeller arc. A Revi C/12D gunsight was installed, and weapons selection equipment allowed the pilot to fire any pair of weapons individually, or in conjunction with other pairs. The standard FuG 7 radio was also fitted and this could be supplemented with the FuG 25 set. The pilot's armor consisted of plates positioned to protect his back and head mounted in an aft-sliding canopy which afforded exceptional visibility. A 300 litre (79 gal.) drop tank could be mounted beneath the fuselage to increase range. Additionally, one 500 or 250 kg (1,102 - 551 lb.) bomb could be carried beneath the fuselage, as required.

In an effort to improve performance, two new engines were installed in production A-1s as *Umrüst-bausätze* (modification construction sets). The Fw 190 A-1/U1 had its BMW 801 C-1 replaced by a BMW 801 D-1, while the Fw 190 A-1/U2 reportedly had the new BMW 801 D-2 engine.

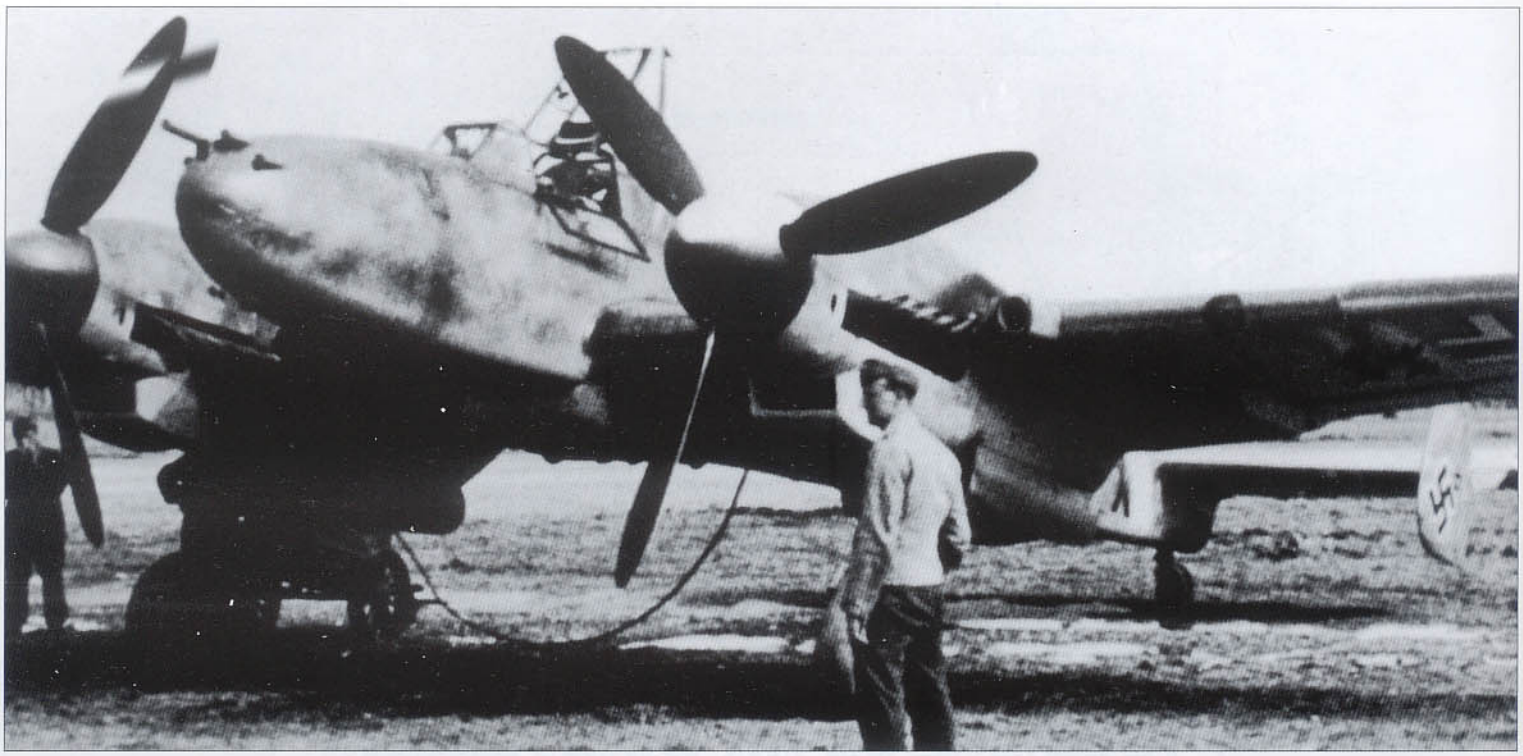
One year after the A-1 series had first appeared, field reports still noted numerous problems with the new Focke-Wulf fighters (which by this time also included the similar A-2 and A-3 series of fighters). In a report filed by JG 26, note was made of the poor handling qualities of aircraft passing through the conversion centers. It was also noted that many license-built parts had poor tolerance control; brakes were not effective, and cockpit canopies were not closing well, due to poor quality control. In addition, pilots complained that the control stick grip, Type 14, ought to be replaced by the KG 12, as the head of the KG 14 was too big. During firing, it was impossible to switch from the central armament to all weapons. These were but a few of the problems facing the industry in its effort to make the new fighter a reliable aircraft.

Above: A brand new Focke-Wulf Fw 190 A-1/U1, W.Nr. 001, SB+KA, taxies prior to its first flight. This particular aircraft was in fact the first example of the A-1 series completed. It was powered by the BMW 801 D-1 and was first series of the Fw 190 to see combat.



Focke-Wulf Fw 190 A-1

1. Fine and coarse altimeter
2. Airspeed indicator
3. Electrical turn and bank indicator
4. Repeater compass
5. Supercharger pressure gauge
6. Tachometer
7. Fuel + oil pressure indicator
8. Oil temperature gauge
9. Fuel contents gauge
10. Low fuel warning light
11. Selector switch for fuel supply
12. Mechanical prop pitch indicator
13. Oxygen indicator
14. Oxygen flow indicator
15. Oxygen flow valve
16. Horizontal stabilizer trim indicator
17. Clock
18. Main instrument panel
19. Secondary instrument panel
20. Left console
21. Right console
22. Holder for signal pistol
23. Signal flare container

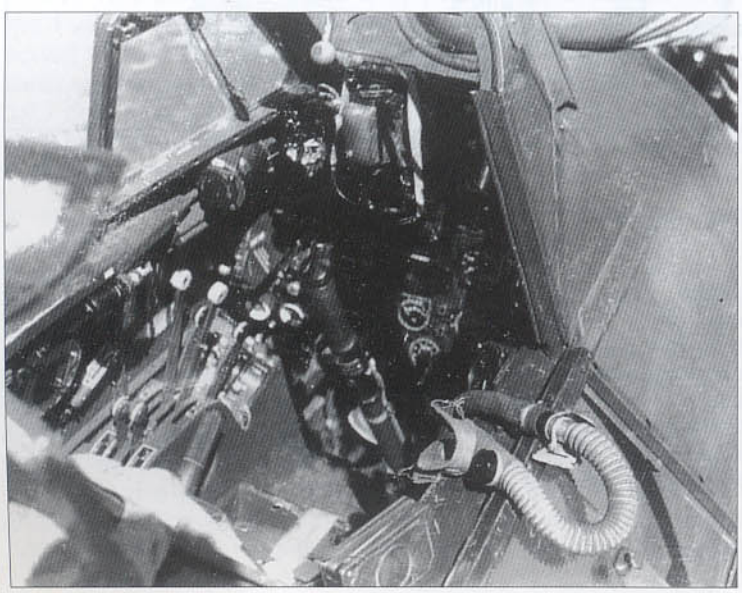


Messerschmitt Bf 110 F-2

This variant appeared in June 1941, and was powered by two DB 601F engines developing 1,350 hp both for take-off and for driving metal, three-bladed, VDM 9-12078 A/B propellers. The most striking difference between this series and earlier models of the Bf 110 rested with the shape of the engine cowls. Just as the single-engined Bf 109 F-series featured a new and refined cowl to enclose its DB 601 E engine, so too did the Bf 110 F-series require a new cowl to enclose its new DB 601 F. This powerplant was externally identical to the DB 601 E, but differed only in having a modified gear reduction ratio.

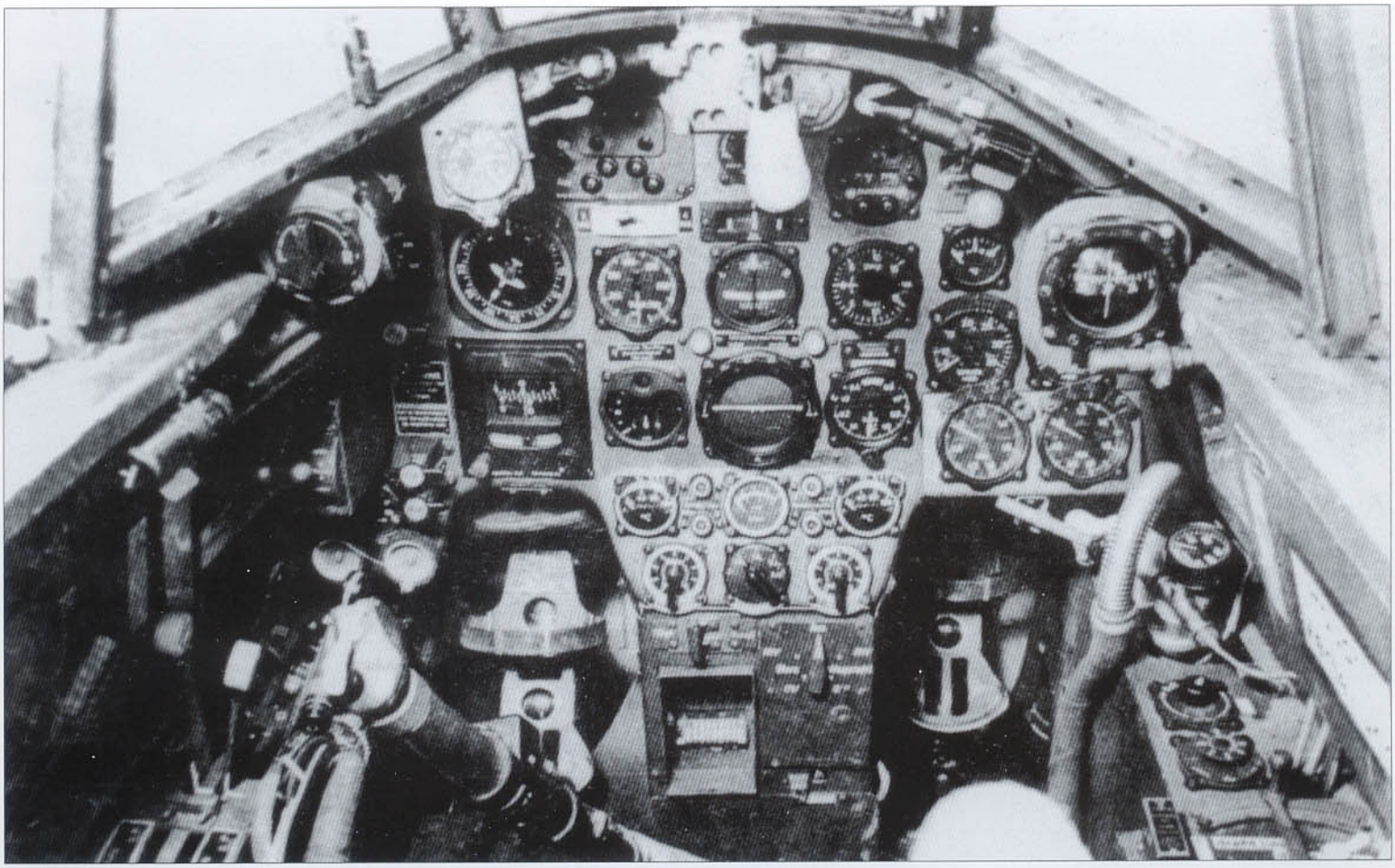
There were relatively minor changes to the airframe apart from the above-mentioned more streamlined engine cowls and spinners. The F-series carried essentially the same equipment, weapons, fuel load and ordinance as the E-series. However, greater crew protection was provided by increasing the armor plating in front of the pilot and aft of his seat. The thickness of the glass side panels was also increased up to 35 mm in thickness. The rear gunner was given more armor in the form of thick bullet-resistant glass mounted slightly above his head.

However, relatively few Bf 110 F-2s were built before this variant was phased out in favor of the more powerful G-series. The operational career of the Bf 110 F-2 was relatively brief spanning twenty months before it was replaced by the Bf 110 G-2 (see page 128).



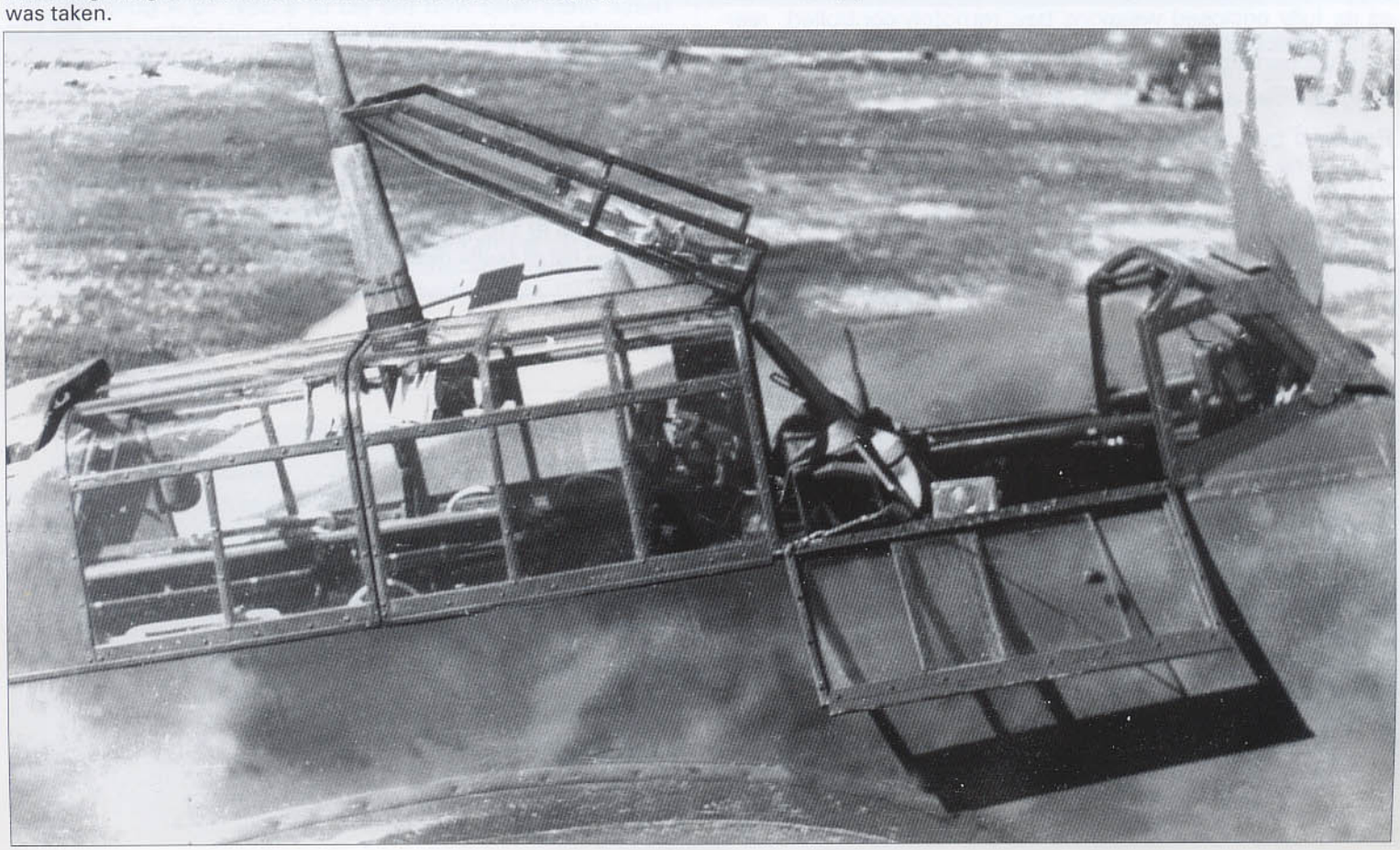
Above: A Bf 110 F-2 being readied for flight shows to advantage the shape of the new cowls which enclosed the DB 601 F engines.

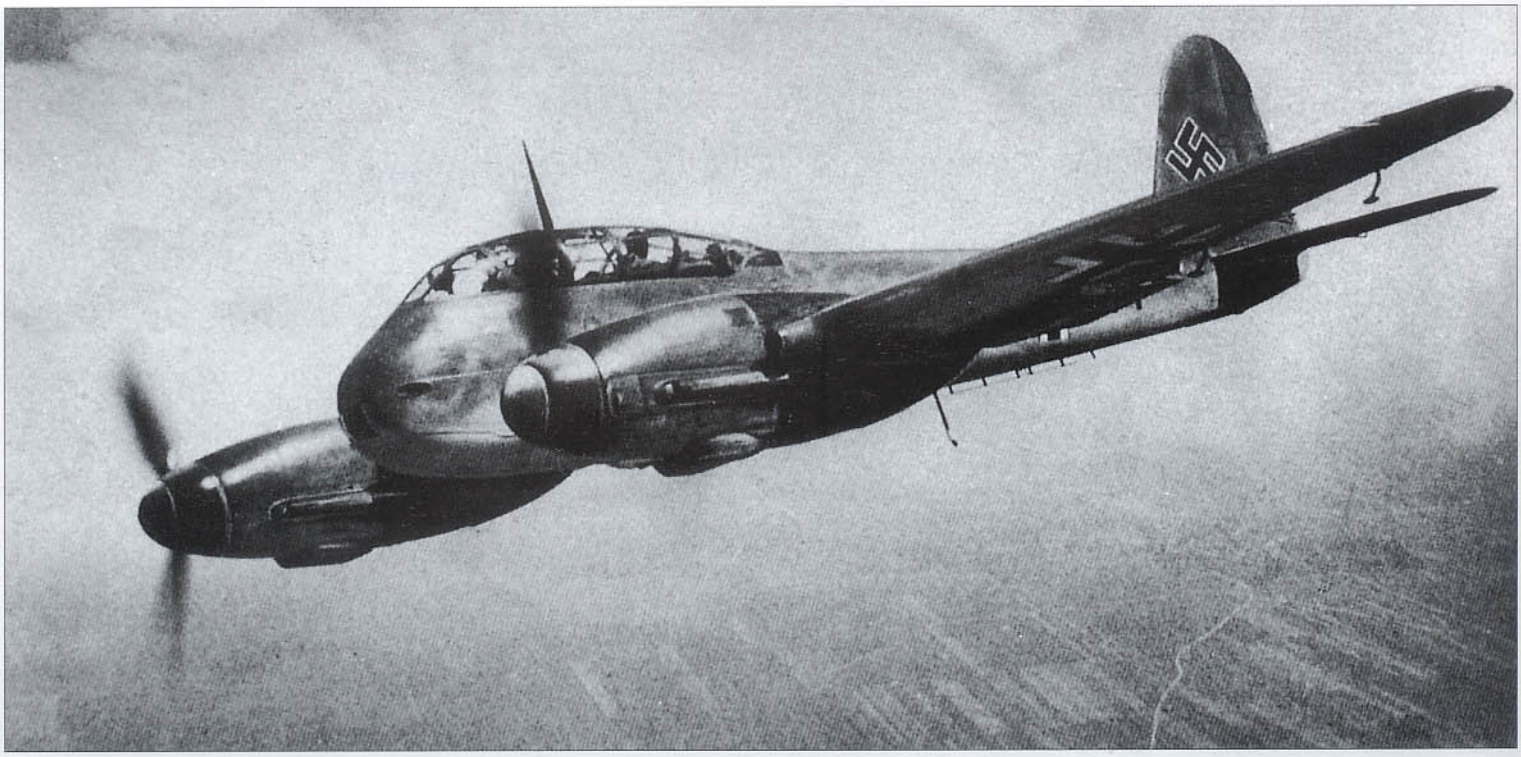
Left: An overall view of the cockpit of the F-1 series with the pilot's oxygen mask laying on the window sill.



Above: A general view of the cockpit of a Bf 110 F-1 which shows some variation from earlier models, most notably the airspeed indicator has been moved to the left of the turn and bank indicator. This grouping of the blind flying instruments indicates a desire to improve bad weather capabilities. Note that the gunsight had been removed before this photograph was taken.

Below: This view of the entire greenhouse shows how access to the pilot's seat is accomplished. The weak point of the Bf 110 continued to be its rear defenses and the lack of satisfactory armor plate for the rear gunner. In an emergency, the rear gunner could quickly bail out by jettisoning the entire rear section of the canopy.





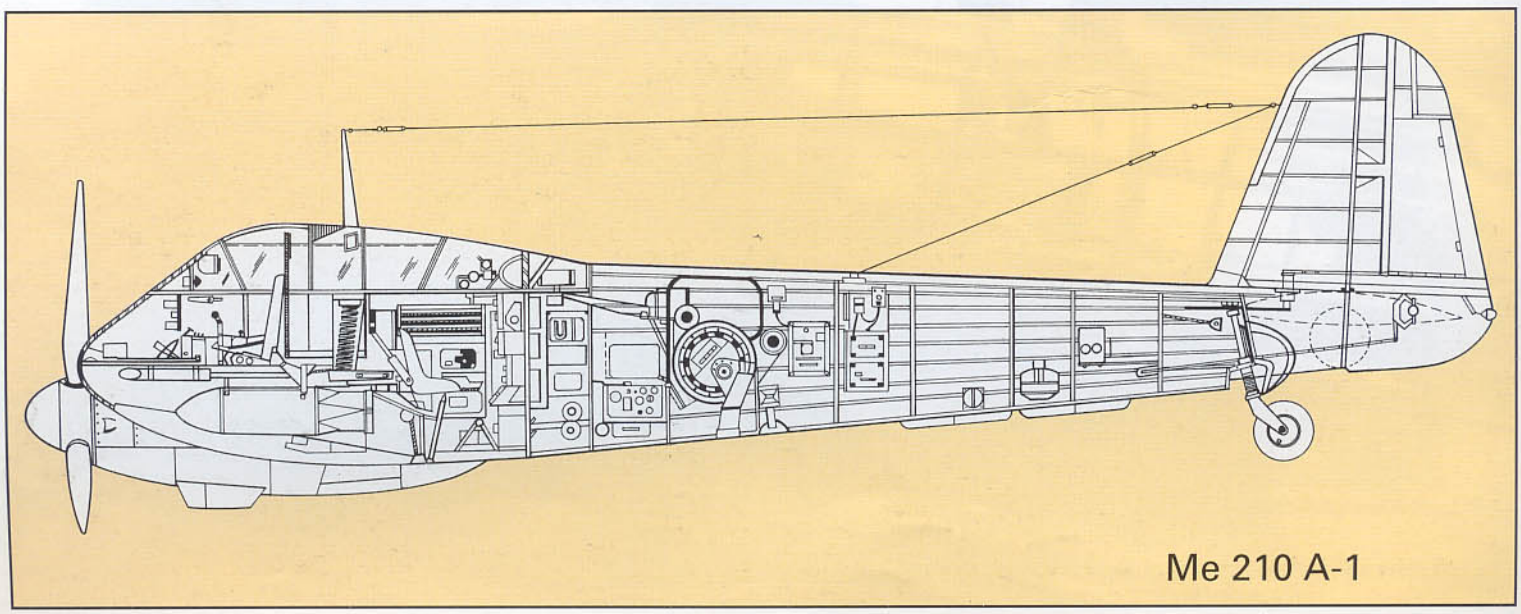
Messerschmitt Me 210 A-1

The Me 210 must surely have been one of Prof. Messerschmitt's greatest disappointments. In spite of solid engineering, an exhaustive test program, and numerous design modifications, the Me 210 never fulfilled its design requirement; that of replacing the Bf 110. By November 1941, when the Me 210 A-1 *Zerstörer* (heavy fighter) first appeared, it had become clear that the whole Me 210 program was less than successful. Although the Me 210 had many innovative features dear to Messerschmitt's heart such as its fully enclosed weapons bay, remotely-controlled rear-firing armament, aerodynamically clean fuselage and powerful engines, these could not off-set the aircraft's poor handling qualities and serious vices.

Powered by two Daimler-Benz DB 601 F engines each driving metal, three-bladed VDM 9-12078 A propellers, the Me 210 A-1 was capable of 350 mph (563 km/h) at 17,850 ft (5,440 m). It is interesting to note that the contemporary Bf 110 F-2 (see page 108), powered by the same engines, was delivering essentially the same performance, while carrying a heavier forward-firing armament.

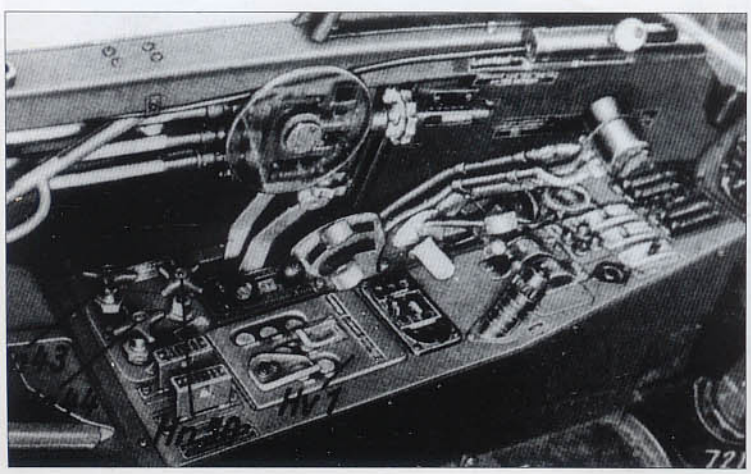
Forward-firing armament was comprised of two MG 17 machine guns, each with 1,000 rpg and two MG 151/20 cannon each with 350 rpg. These were fired with the aid of a Revi C 12 C gunsight. Rear-firing weapons consisted of two FDSL 131B remotely-controlled side-mounted gun turrets, each fitted with one 13 mm machine gun with 500 rpg. These were fired with the aid of a Revi 16 A gunsight The internal bomb load could be comprised of either two SC 500 bombs (1,102 lbs) or one PC 1000 bomb (2,204 lb).

Above: The graceful lines of the Me 210 are evident in this view of Me 210 A-1, W.Nr. 0182, VN+AT. Although intended to replace the Bf 110, it never accomplished this mission due to the long list of faults discovered during test flights.

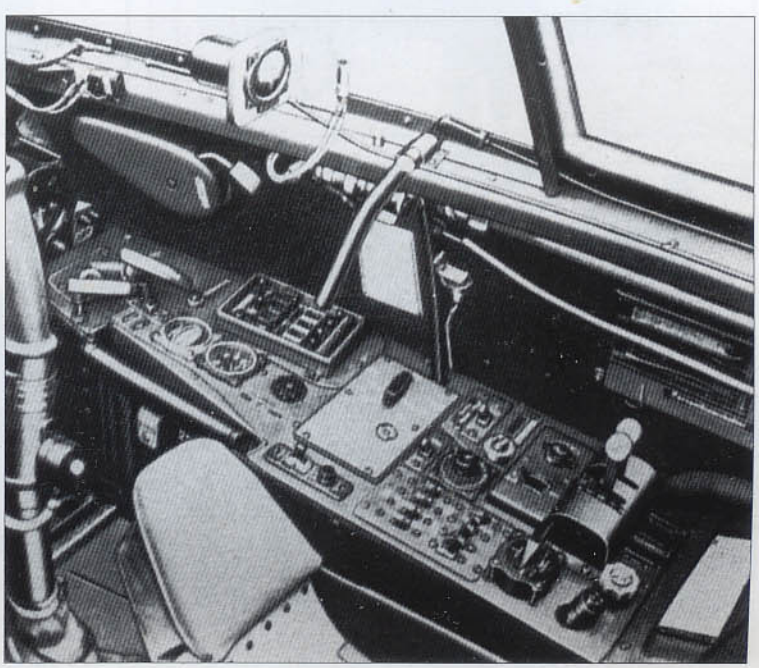


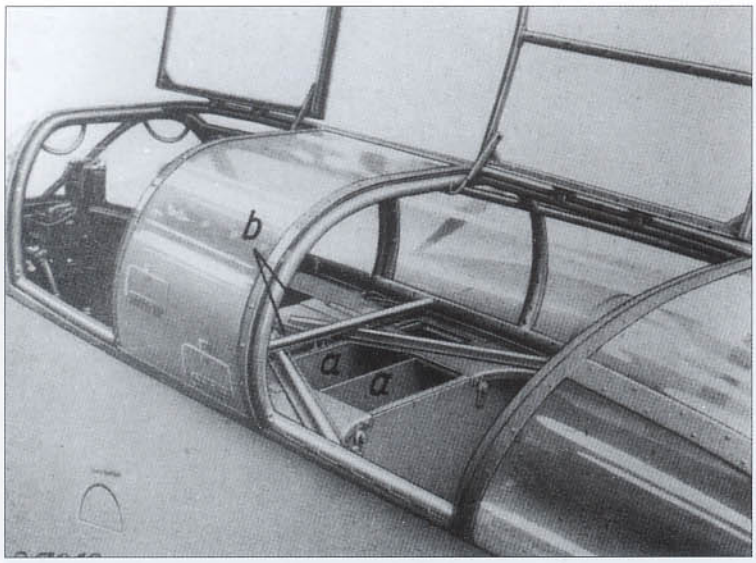
Above: An overall view of the Me 210 A-1s cockpit as reproduced from the type's handbook. Item (a) is the power plug for the Revi C/12D gun sight, (b) is the gun sight arm, (c) shows the Revi C/12D gunsight, (d) is the port console, (e) is the SZKK 4 round counters, and (f) type KG 14 control grip. Like the Bf 110, there existed differences between various marks of the Me 210.

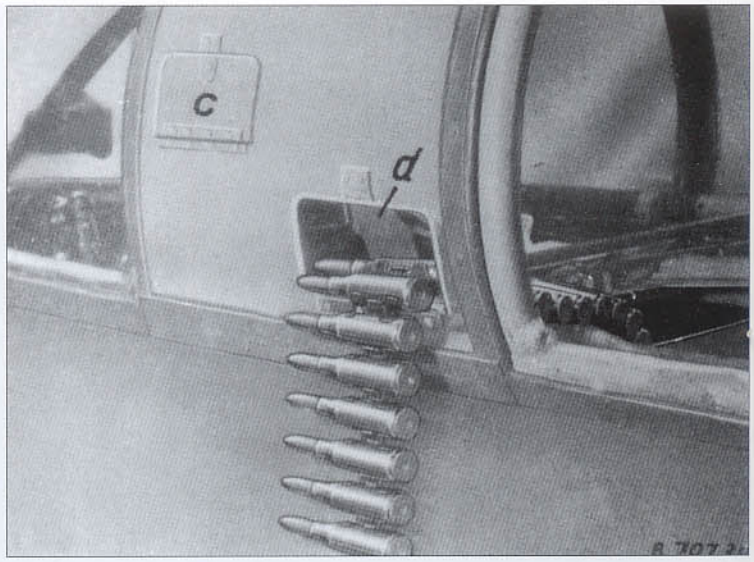
Below left: Port side console containing the main engine controls. At the top end are the ammo counters and at the aft end are the taps for the dive bombing air brakes and bomb doors (HN 43), landing gear (Hn 44), and landing flaps (Hn 45).

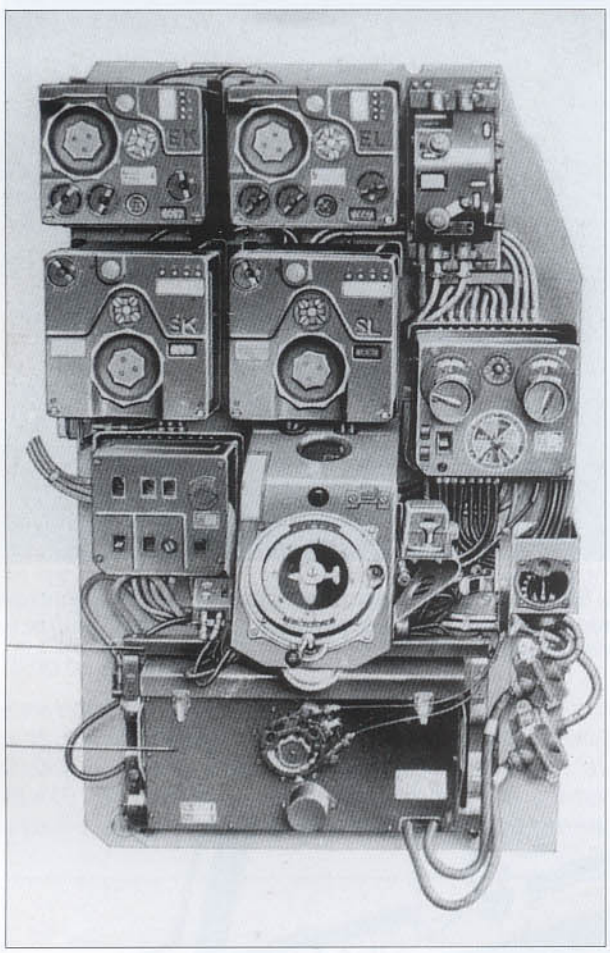


Below right: Starboard side console with its oxygen flow controls, armament selector panel, lighting switches and dimmer control for the cockpit instrument lighting.









Above left: A view of the ammo storage bins for the MG 151/20 (a) and MG 17 (b).

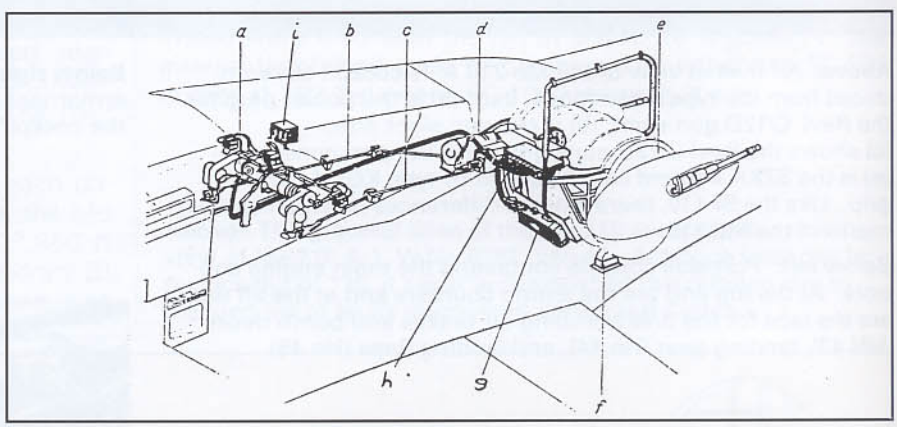
Above Right: Loading doors for replenishing the ammo bins (c) MG 17 and (d) MG 151/20.

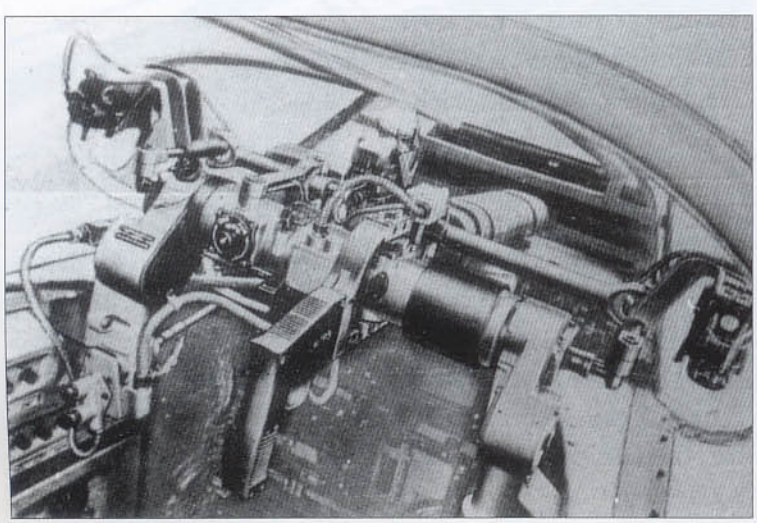
Left: The FuG 10 radio equipment and the main navigation equipment from the rear cockpit. The short wave and long wave receivers are at the top flanked by the remote control tuning device for the D/F loop system. Below are the short and long range transmitters with the main radio control box to the right. The intercom switch box is to the left of the Patin repeater compass. The bottom box contains the compass receiver unit.

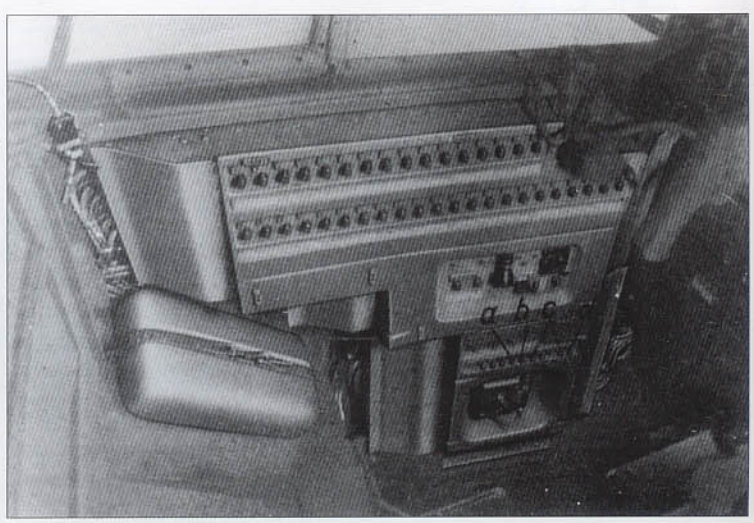
Bottom left and below: The single pistol grip fire control for the twin MG 131 machine guns. A Revi gunsight is mounted above the control arm linkeage.

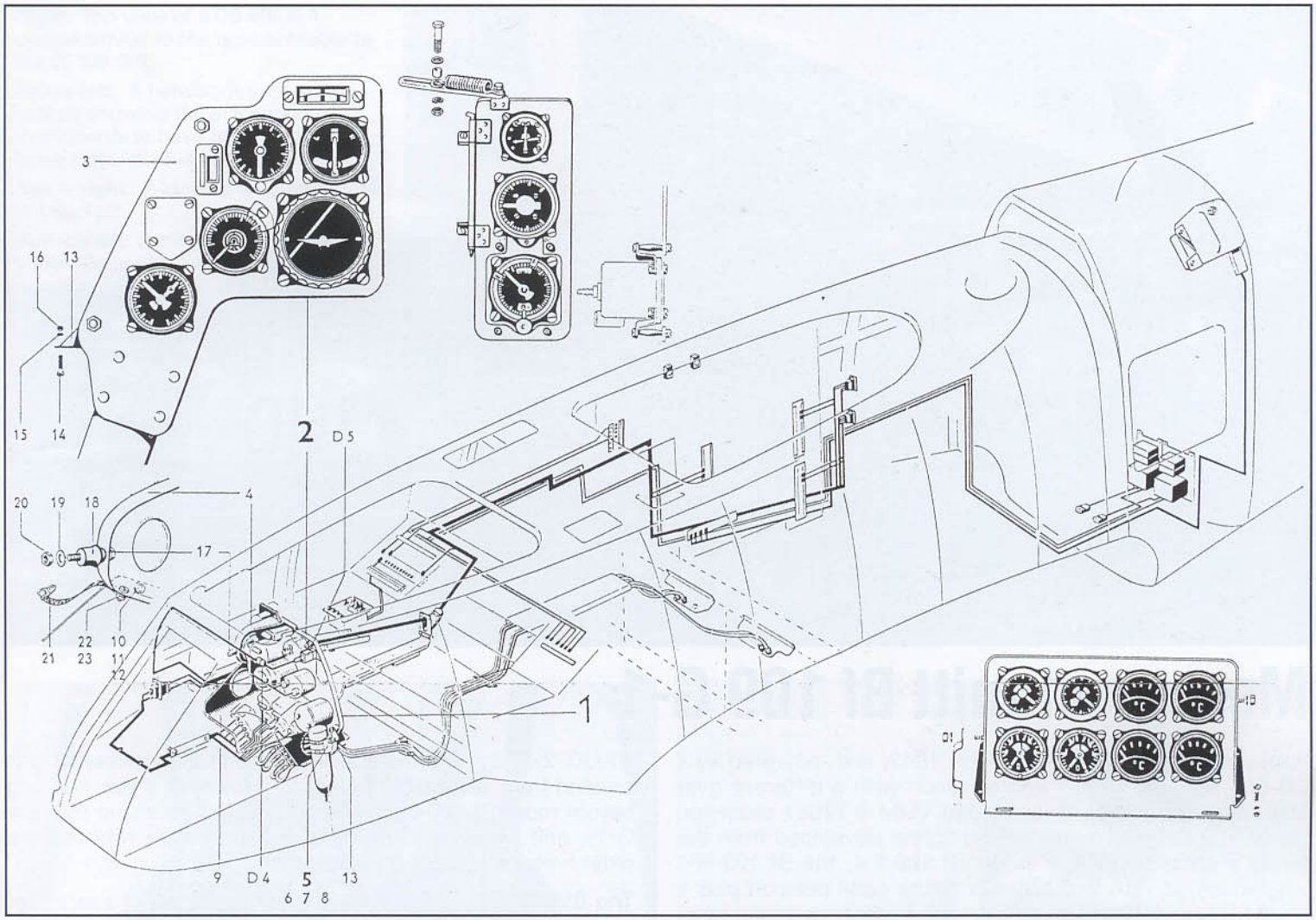
Bottom Right: The starboard wall of the rear cockpit showing the main circuit breaker panel.

Opposite page: Various views showing the placement of engine and flight instruments.





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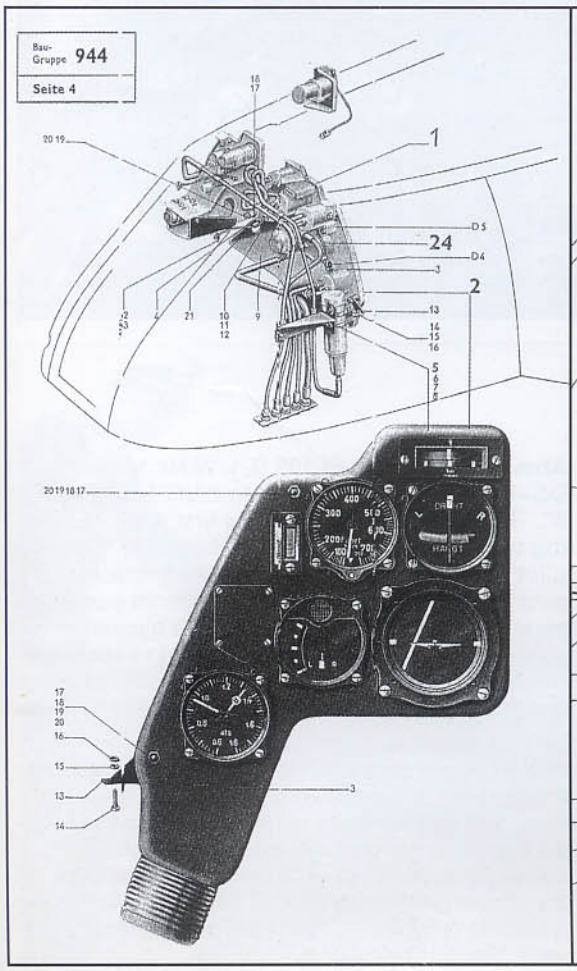
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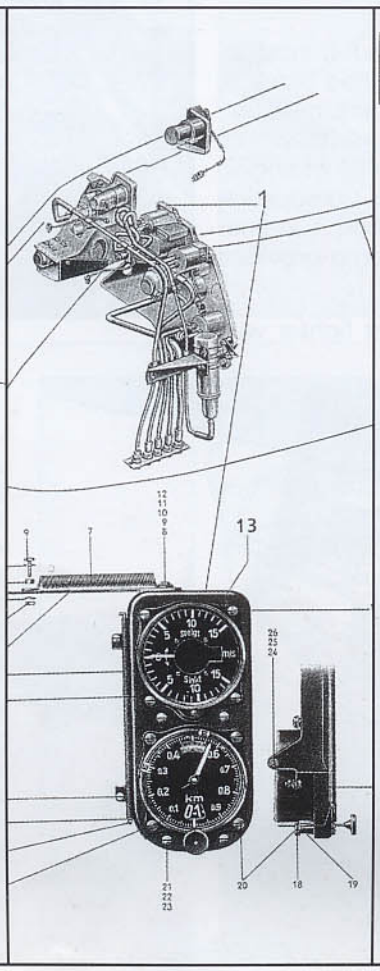
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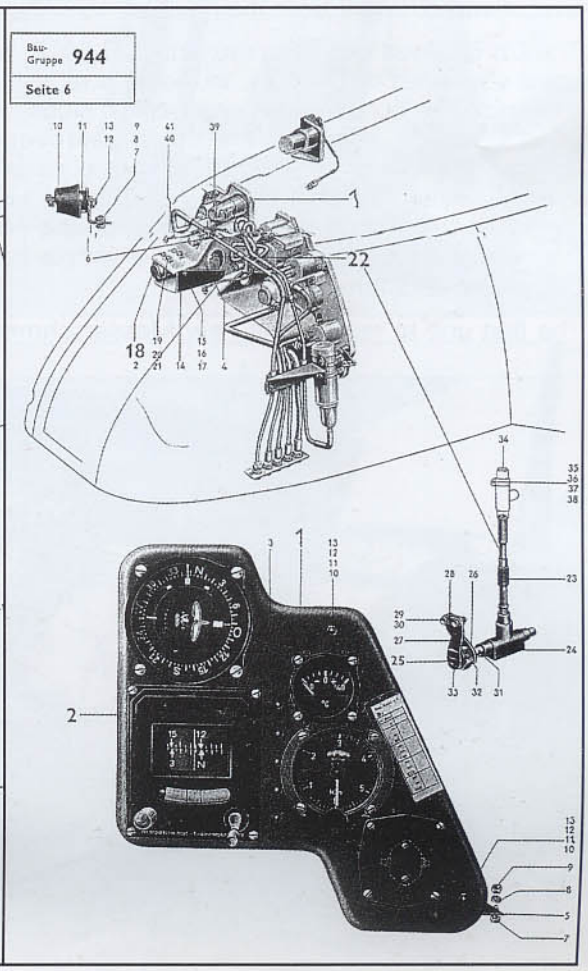
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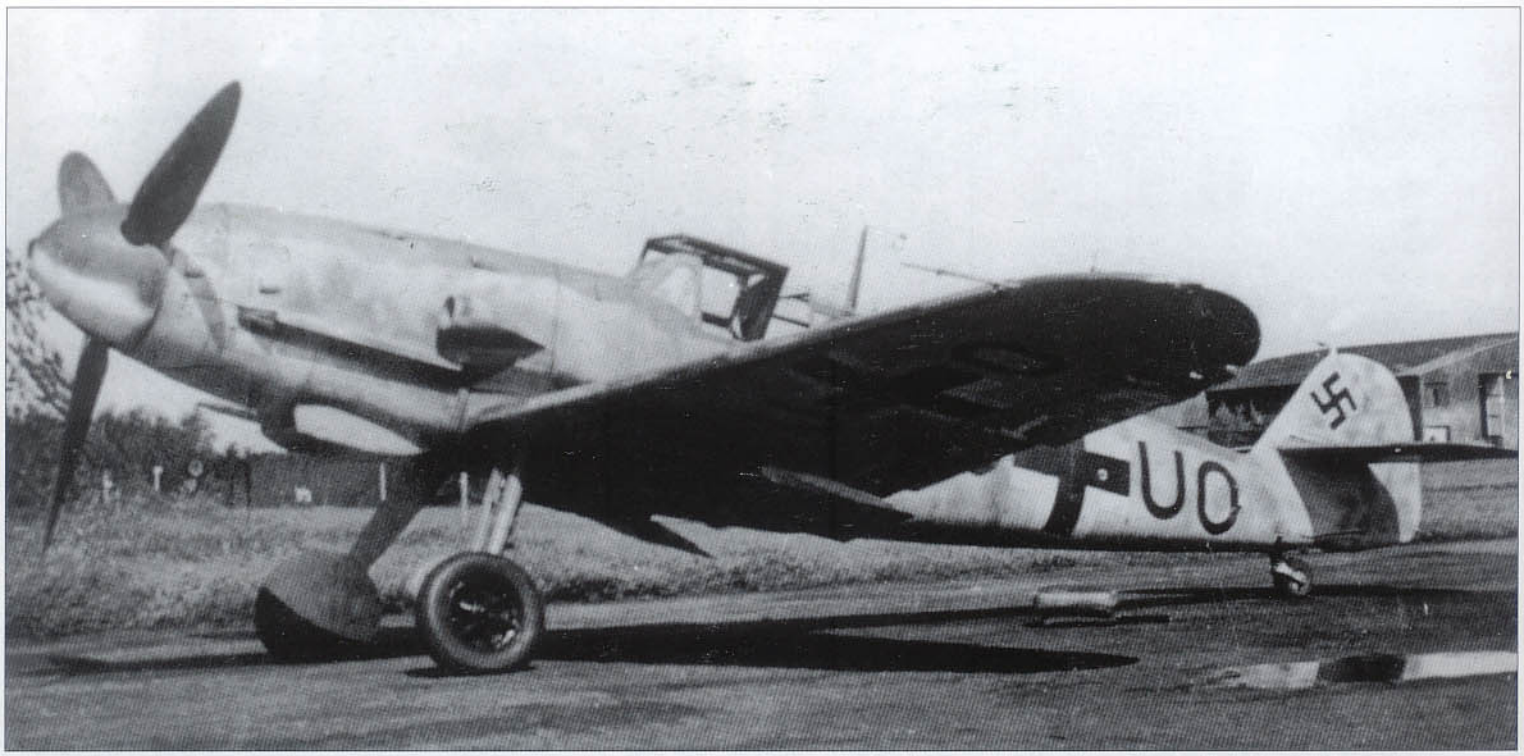


Messerschmitt Bf 109 G-1

Appearing for the first time in May 1942, and powered by a DB 605 A-1, B-1 or C-1 engine (each with a different gear ratio) driving a metal, three-bladed VDM 9-12087 propeller, the Bf 109 G-1 was a pressurized fighter developed from the earlier F-series. Like the earlier Bf 109 F-4, the Bf 109 G-1 was equipped with two MG 17s at the cowl position plus a MG 151/20 engine-mounted cannon. In other respects however, it was different from the F-series.

The DB 605 was similar to the older DB 601E, but it incorporated a number of changes, including a redesigned block to maximize the bore, repositioned spark plugs, and modified main bearings. There were other improvements which enabled the fighter to keep pace with constantly changing war demands. The Bf 109 G-1 was also the first production variant of the Bf 109 to be pressurized. The cockpit interior was sealed to prevent leakage and a simple pump provided the pressure differential.

The first unit to receive the new Messerschmitt fighter was 11./JG 2, Richthofen, a special high-altitude interceptor unit created from elements of 1./JG 2. However, it was not long before most Bf 109-equipped units began receiving the new G-1s, and by the end of 1942, it had virtually replaced the older F-series as front-line equipment.

The Bf 109 G-1 was eligible for the installation of a variety of optional equipment installation including the following:

R1 – ETC 500/IXb under fuselage bomb rack.

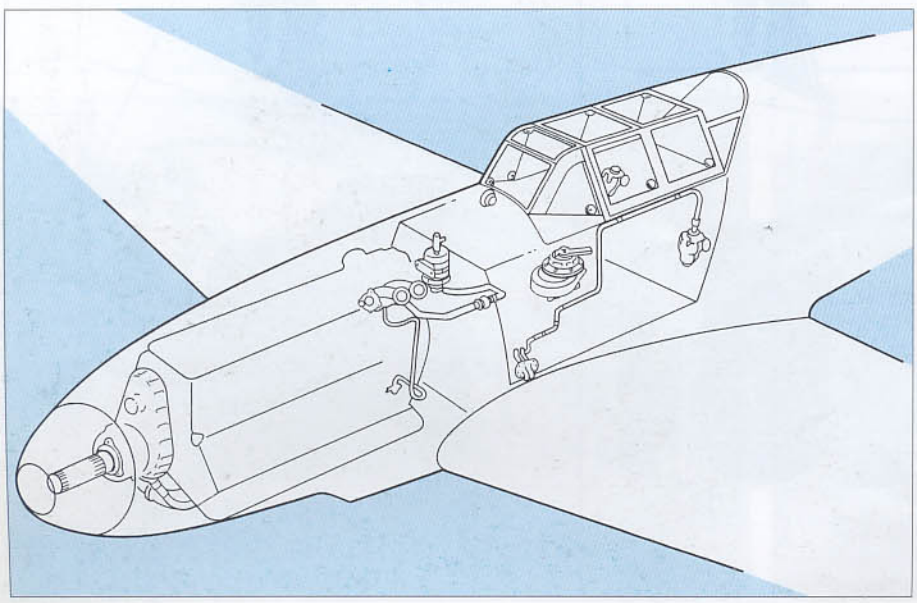
R2 – GM 1 powerboost fitted without armor or R6.

R3 – 300 litre auxiliary underfuselage drop tank.

R6 – 2 x MG 151/20 cannon mounted beneath the wings

U1 – Me P 6 reversible pitch prop

U2 – GM 1 powerboost with armor and R6.



Above: A standard Bf 109 G-1, W.Nr. 14150, DG+UO, prior to its transfer to 2./JG 1 as "black 6". The pressurized G-1 series first appeared during the spring of 1942, but on March 18, 1943, the pilot of this aircraft, *Lt.* Gerhard, was attacked over the North Sea. His Messerschmitt sustained serious damage while Gerhard was himself wounded in the attack. He managed to successfully bail out of his stricken fighter, and was rescued but later died of his injuries.

Left: A schematic ilustration of the cabin pressurization equipment showing (a) air compressor, (b) check valve, (c) ventilating air filter, (d) pressure vent, (e) high pressure relief valve, (f) low pressure compensation vent, (g) quick equalizing valve, (h) suction valve, (i) compressed air line, (k) static compressed air line, (l) ventilation line, (m) lubricant low line, (n) hygroscopic element to prevent mist formation.

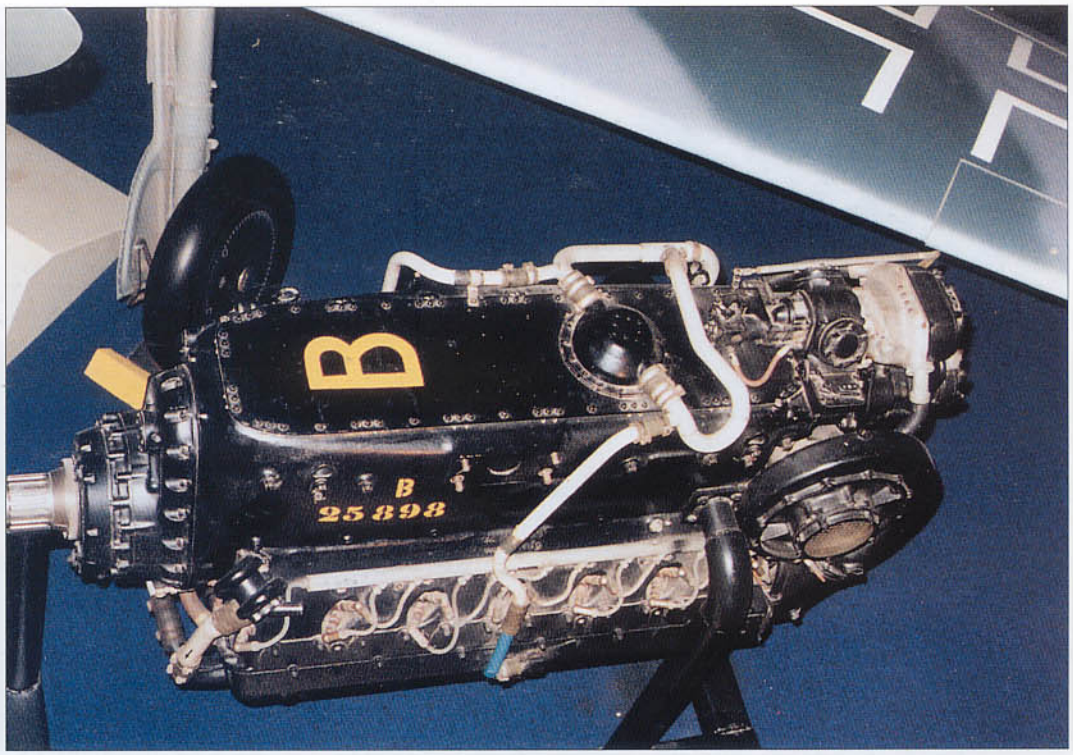
Right: Top view of a DB 605 B-1 engine similar to the type available to the Bf 109 G-1.

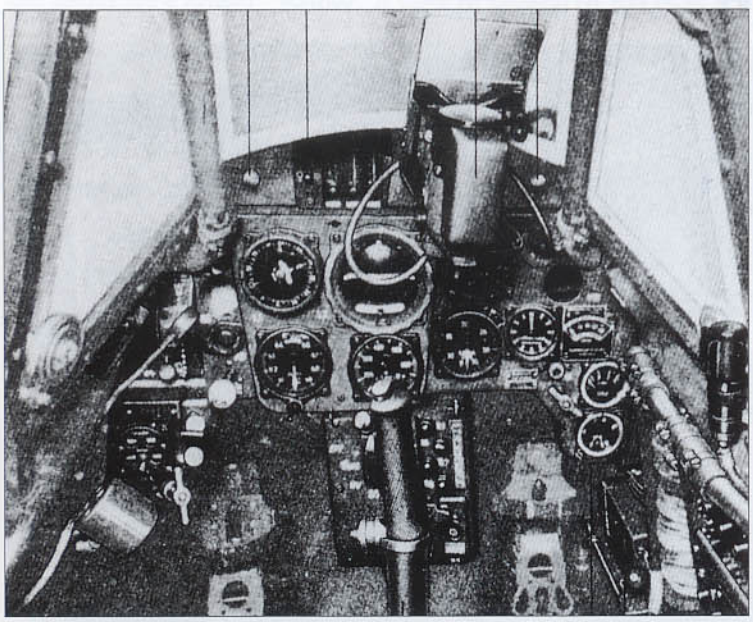
Below left: A handbook view of the cockpit showing the placement of instruments to have been closely patterned after the F-4 series.

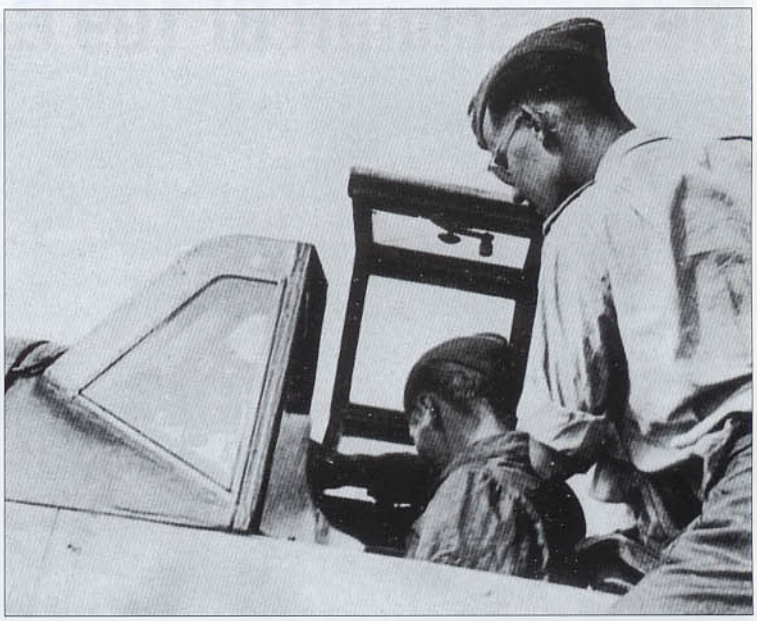
Below right: A view of an operational G-1 cockpit.

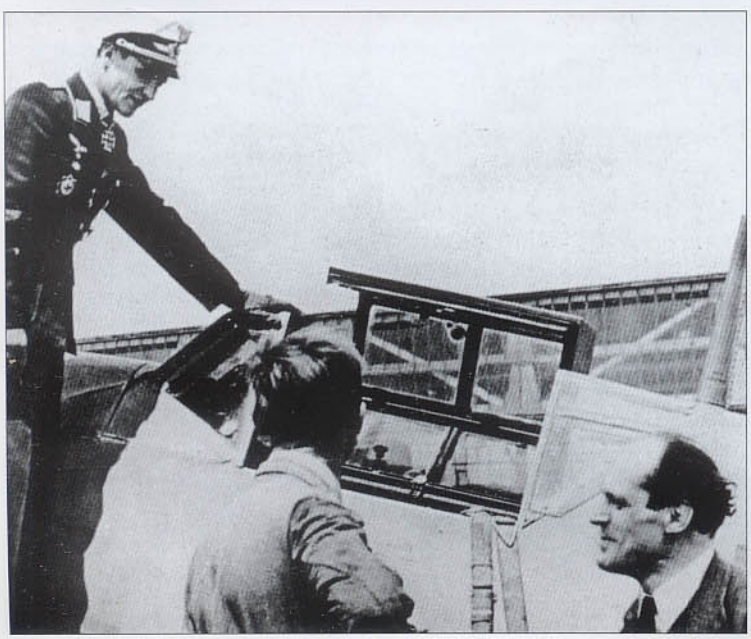
Bottom left: An interesting moment when 23-year old ace *Hptm.* Hans-Joachim Marseille is shown a brand new Bf 109 G-1 at the Messerschmitt works in Regensburg, while *Prof.* Messerschmitt (right) looks on approvingly. Within a short period, this young ace, with 158 victories, was fatally injured on September 30, 1942, while bailing out of a malfuctioning Bf 109 G-2 over north Africa.

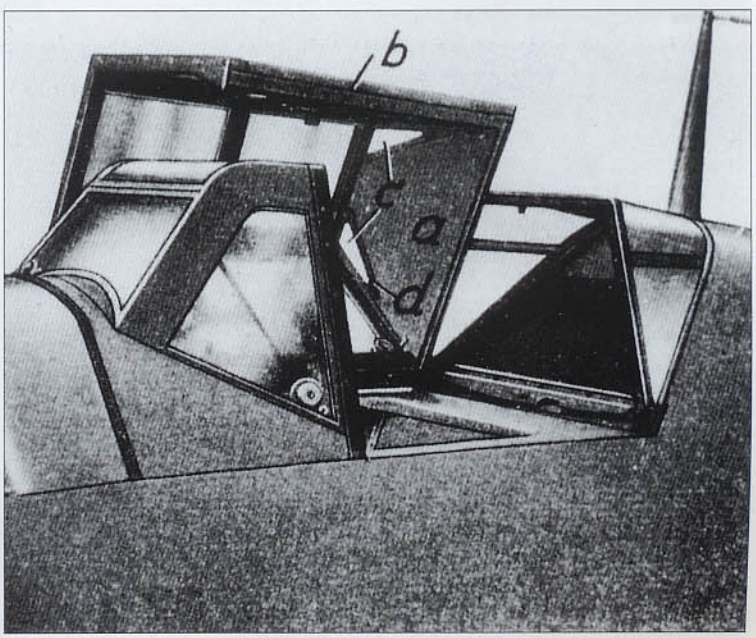
Bottom right: A handbook view of the new canopy design chosen for the G-series showing the heavier framing and built-in bullet resistant windscreen.











Messerschmitt Bf 109 G-2

The non-pressurized Bf 109 G-2 series appeared in May 1942 concurrently with that of the pressurized G-1 described in the preceding pages. Apart from the pressurization feature, it was essentially identical to the G-1. Since the cabin was not pressurized, small rectangular air-flow vent-hatches were positioned on both sides of the cockpit just beneath the forward side window pane. Additionally, a small cabin-vent air-scoop was positioned just below both sides of the windscreen side panes.

No precise production breakdown by subtype for the G-series has been discovered, but based on other surviving data, such as loss reports, it appears that production of the G-2 series greatly exceeded that of the G-1. In addition, as with the G-1, the G-2 was rapidly allocated to most Bf 109-equipped units, and by autumn 1942, the type was in action on all fronts.

Optional equipment items for the Bf 109 G-2 included the following:

R1 – ETC 500 IXb bomb rack beneath the fuselage.

R2 – Rb 50/30 reconn camera with R3 and no MG 151/20.

R2 – Rb 75/30 with 2 x 300 ltr under wing tanks, no MG 17s.

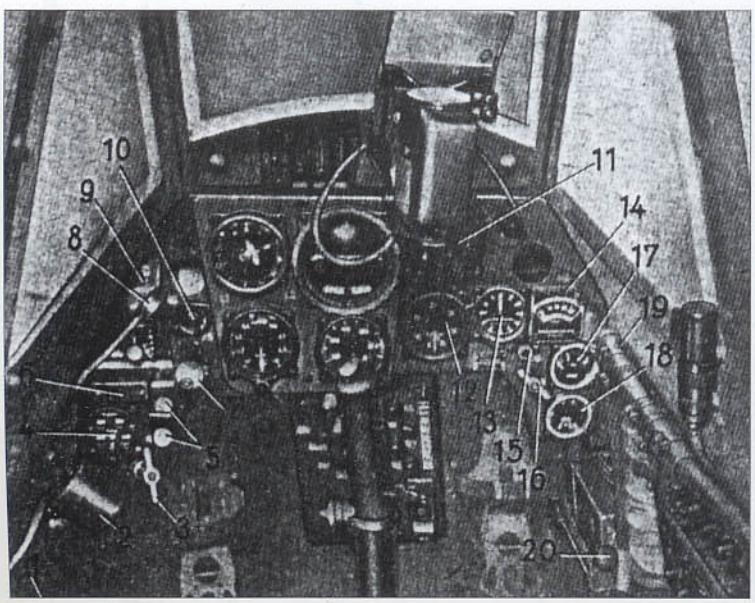
R3 – 300 ltr. auxiliary fuel tank beneath the fuselage.

R4 – Rb 50/30 with 2 x 300 ltr under wing tanks and, MG 17s.

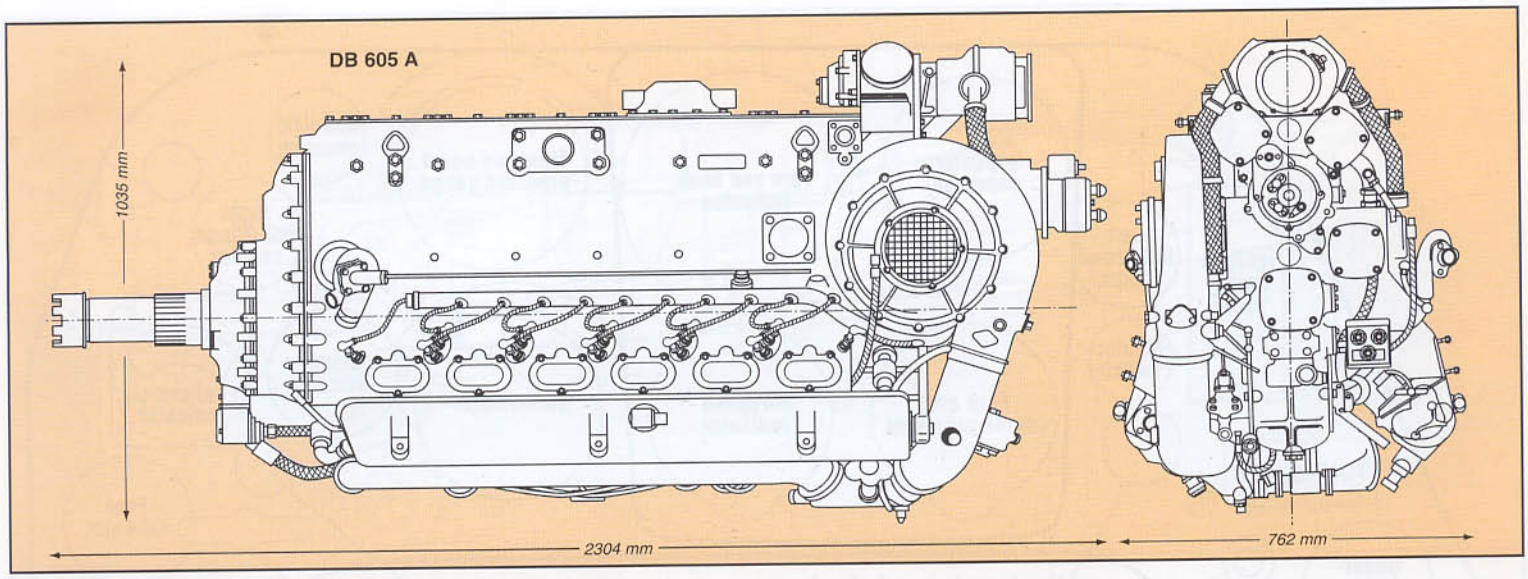
R6 – 2 x MG 151/20 cannon mounted beneath the wings.

U1 – Me P 6 reversible-pitch propeller assembly.

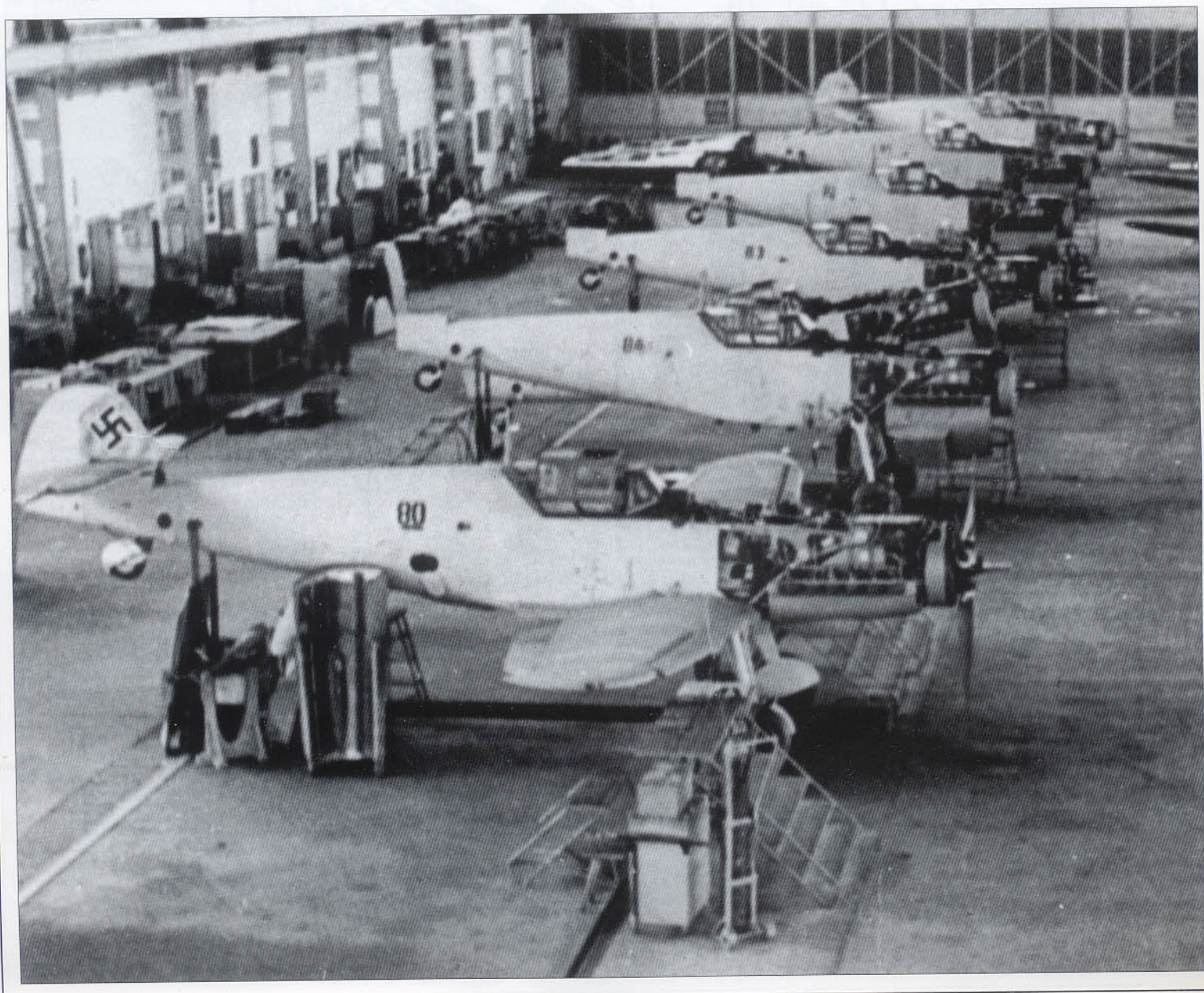
Above: This Bf 109 G-2/R6, EN+EL, frequently reported as yellow 12, flown by *Oblt.* Heinrich Ehrler, *Staffelkapitäin* of 6./ JG 5, but may in fact be yellow 3 assigned to *Obfw.* Rudolf Müller of the same unit. The aircraft of both airmen had similar winter camouflage.

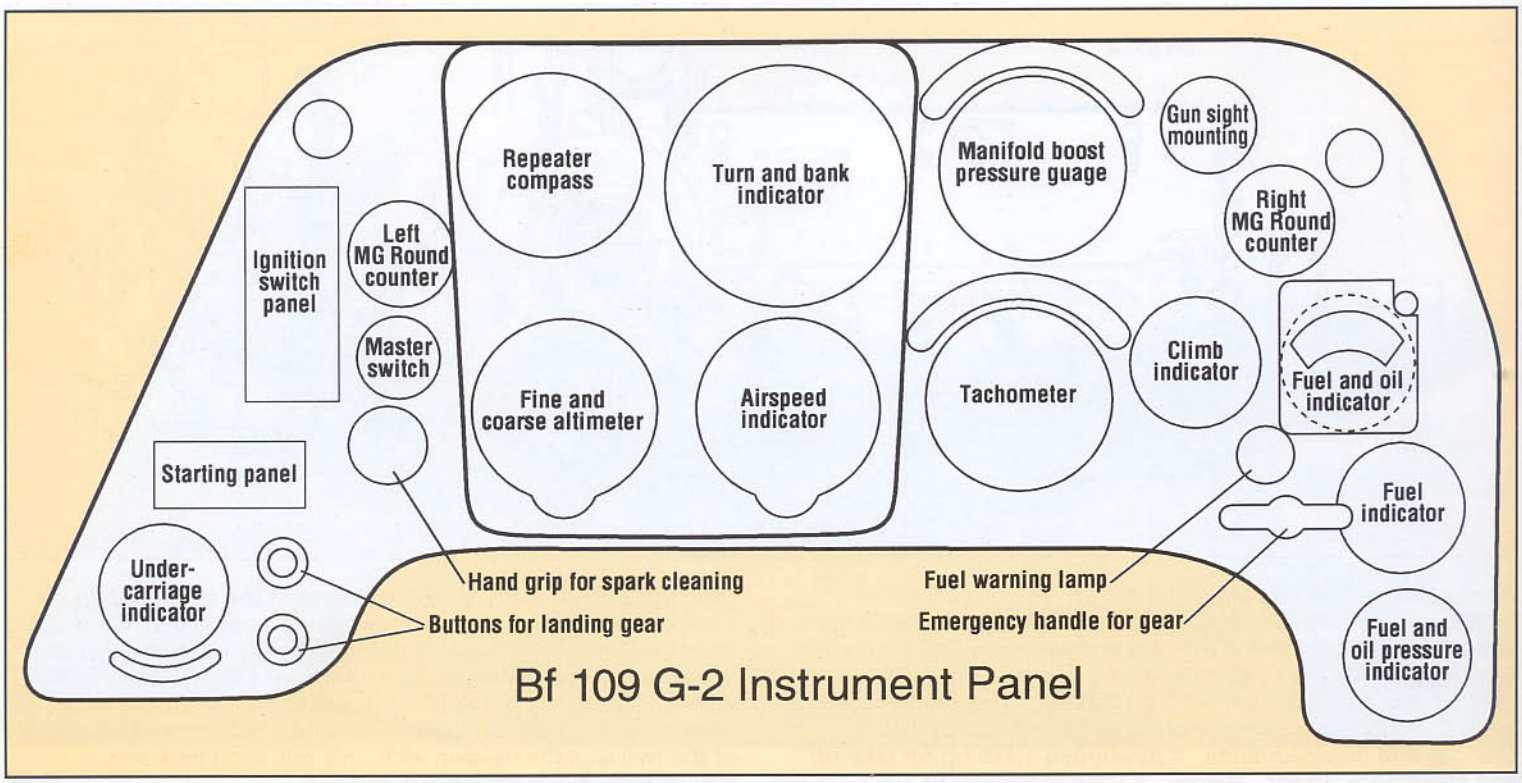


1. Saftey cock switch
2. Throttle
3. Hand grip for supercharger intake shield (trop versions)
4. Undercarriage position indicator
5. Undercarriage switch
6. Starting panel
7. Hand grip for spark plug cleaning
8. Hand lever for canopy jettison
9. Ignition panel switch
10. Master switch
11. Manifold pressure gauge
12. Tachometer
13. Prop pitch indicator
14. Coolant + oil temperature gauge
15. Low fuel warning light
16. Emergency gear hand grip
17. Fuel contents indicator
18. Fuel + oil pressure gauge
19. Clear glass fuel flow verifier
20. Hand grip for coolant and radiator cut-off



Above: A side and end view of the Daimler-Benz DB 605 A twelve-cylinder inverted vee liquid-cooled 35.7 litre engine with a bore and stroke of 154 x 160 mm and a compression ratio of 7.3:1 (left block), 7.5:1 (right block) requiring B4 fuel. The supercharger was a single-stage with a 16-bladed impeller. This 1941 engine was based on the DB 601 E but with a number of changes and improvements. It developed 1,475 hp for take-off and emergency power. **Below:** A view of several Bf 109 G-2s nearing final assemby showing details of the starboard engine compartment. The aircraft in the foreground is a Bf 109 G-2/R2, a reconnaissance variant, as denoted by the open oval access hatch located on the lower rear fuselage. Interestingly, there were two versions of the R2 as noted opposite. Both models were employed by reconnaissance units, but the more common of the two was the version with only one drop tank and equipped with the Rb 50/30 camera.



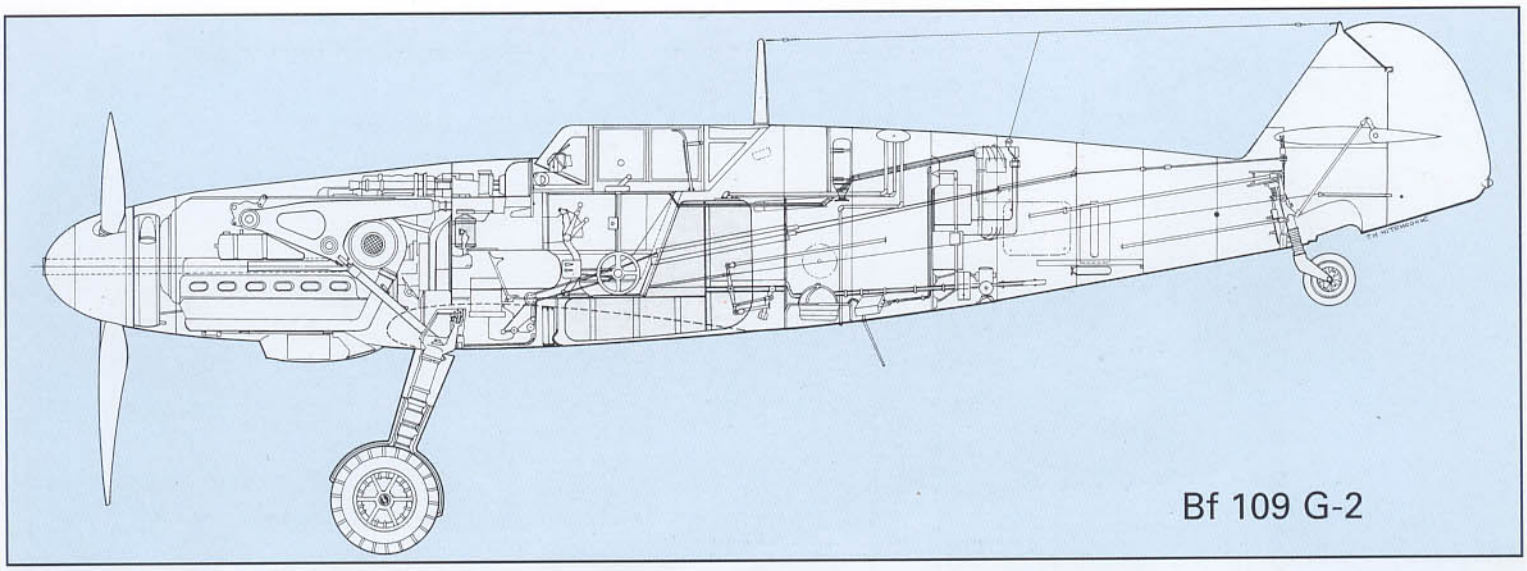


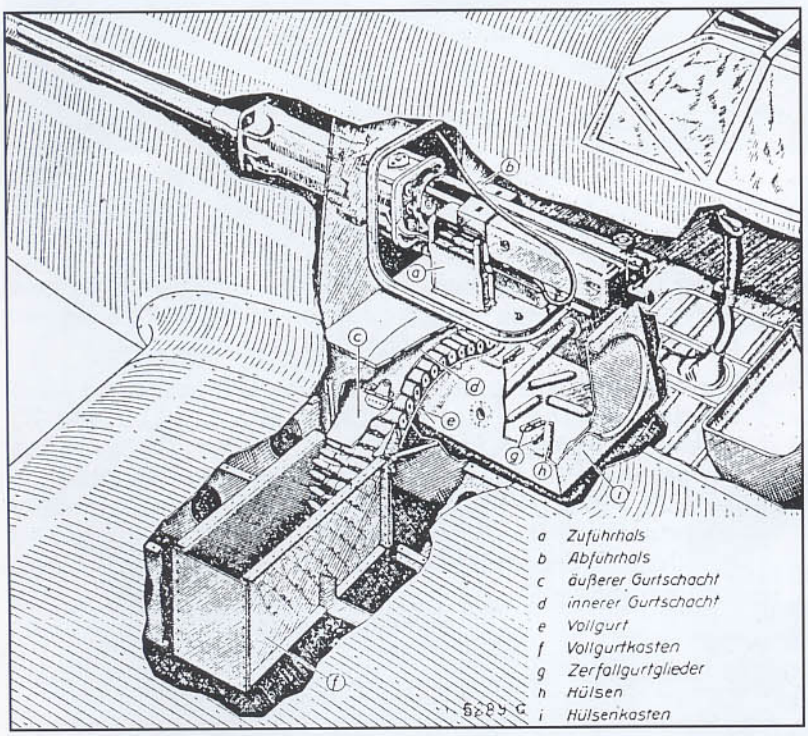
Bf 109 G-2 Instrument Panel

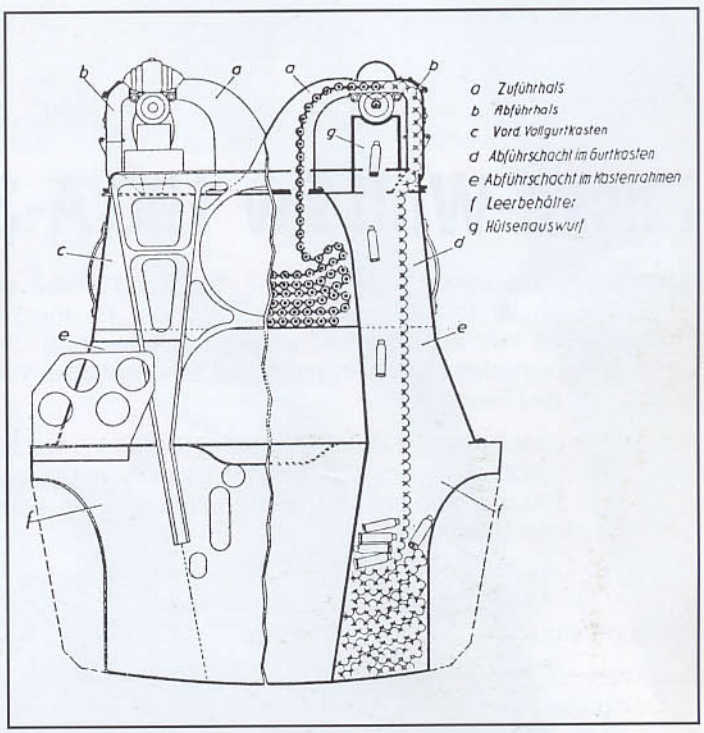
Top: Instrument panel for the Bf 109 G-2.

Above and below: Port and starboard view of the canopy of the non-pressurized G-2. Note the small low pressure cabin vents beneath the windscreen which were introduced with this series.

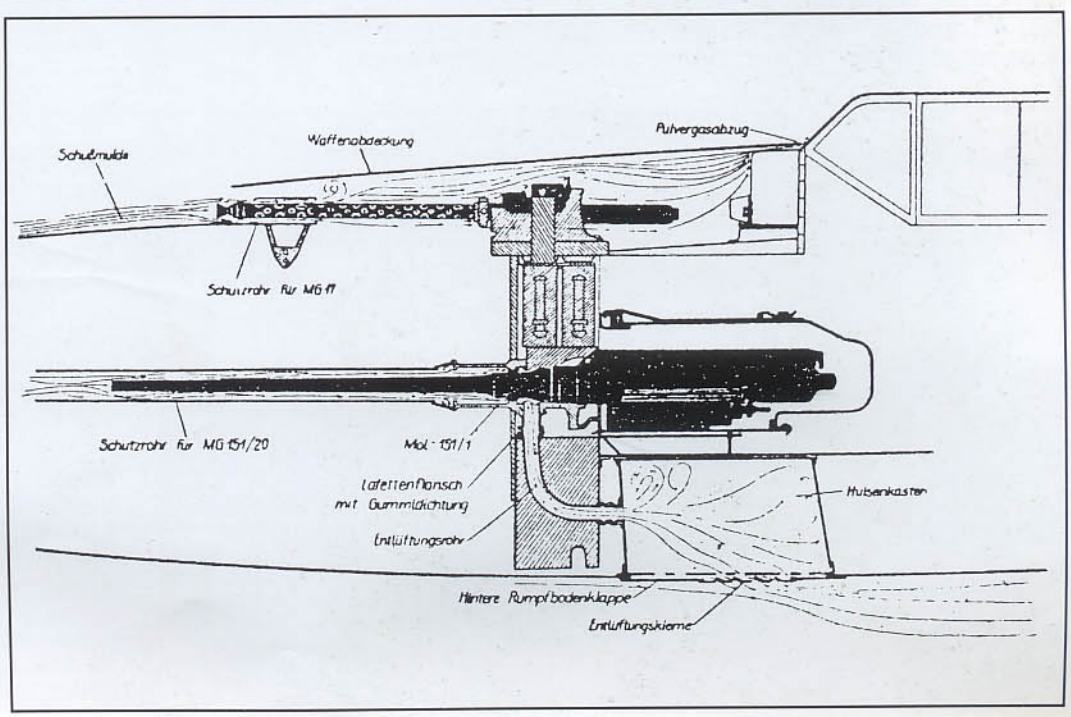
Left: An overall view of the restored cockpit of Bf 109 G-2/tp, W.Nr. 10639, black 6, now on display in Britain.

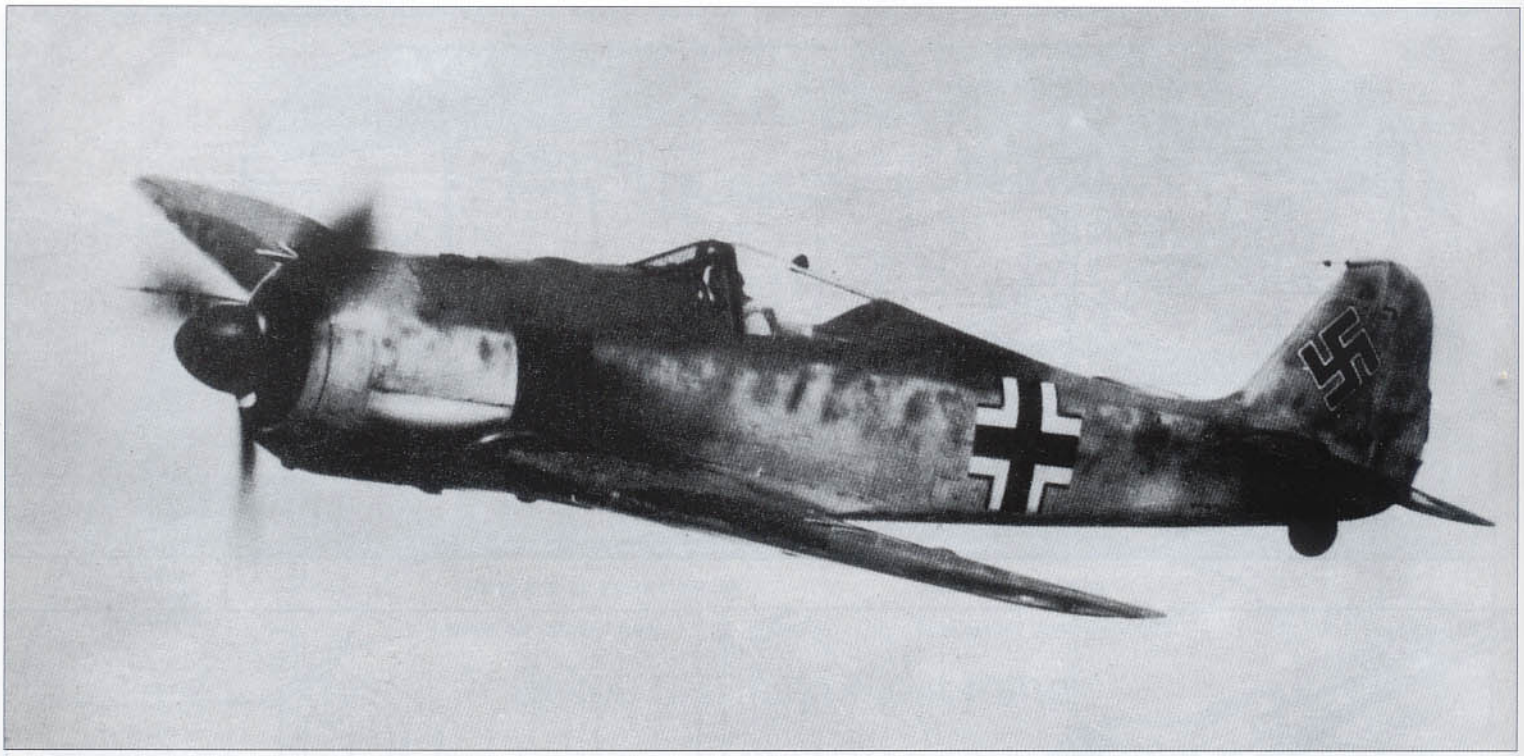






Above, above right and right: Various handbook illustrations showing the standard armament for the Bf 109 G-2 (which was also applicable for the Bf 109 F-4 and Bf 109 G-1 series). This comprised an engine-mounted 20 mm Mauser MG 151/20 cannon with 200 rounds plus two cowl- mounted 7.9 mm MG 17s with 500 rpg. Ammunition for the cannon was contained within the port wing and fed directly to the weapon as shown above. Spent shells were ejected into a container immediately below the weapon.





Focke-Wulf Fw 190 A-3

Powered by the new BMW 801 D-2, the Fw 190 A-3 was otherwise similar to the previous A-2 model. By the time production of this subtype had ended in December 1942, some 500 examples had been produced among Focke-Wulf, Arado, Ago and Fieseler.

Armament consisted of two cowl-mounted MG 17 machine guns with 1,000 rpg, two MG 151/20 cannon in the wing roots with 200 rpg; and two MG FF/M cannon in the wings, outboard of the landing gear, each with 55 rpg.

The designated prototype for this series was the Fw 190 V14, W.Nr. 190-0125-201, which was also utilized in the development of the A-0 and A-2 series

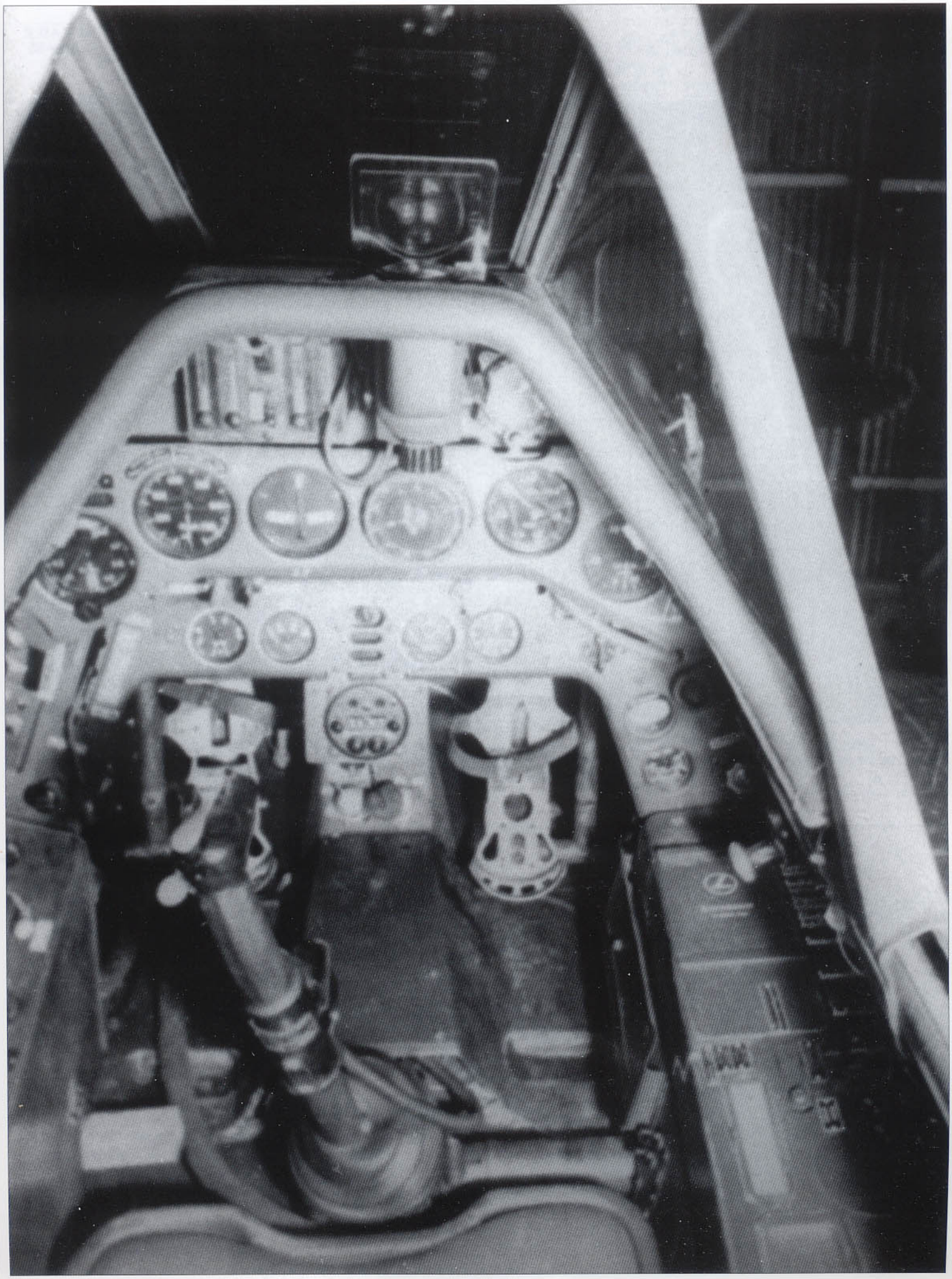
A number of fighter units took delivery of the Fw 190 A-3 including elements of JG 1, JG 2, JG 5 and JG 26. Most of these units, which were also equipped with aircraft of the Fw 190 A-1 and A-2 series, were instrumental in working the bugs out of the new fighter. Many of the early problems centered upon quality control issues and reliability of the new BMW 801. By the time production of the A-3 series had peaked, most service objections had been corrected.

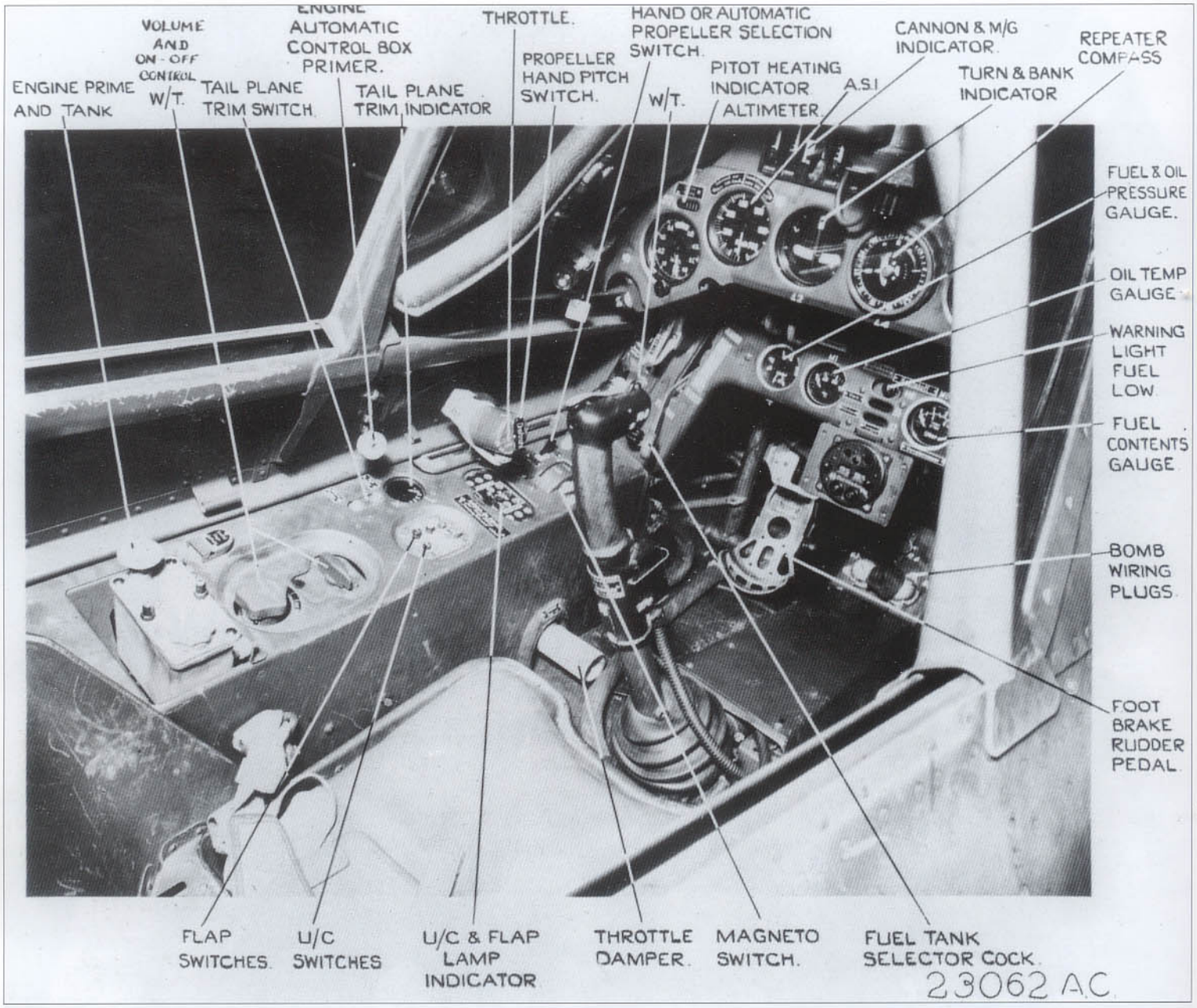
The first complete example of the Fw 190 to fall into Allied hands was the Fw 190 A-3, W.Nr. 313, piloted by *Oberleutnant* Arnim Faber of III./JG 2. *Oblt.* Faber made a navigational error and landed by mistake at RAF Pembrey on June 23, 1942. This particular Fw 190 A-3 was an especially important war prize for the Allies. Over the next twelve months, the aircraft was extensively studied and evaluated by the RAF.

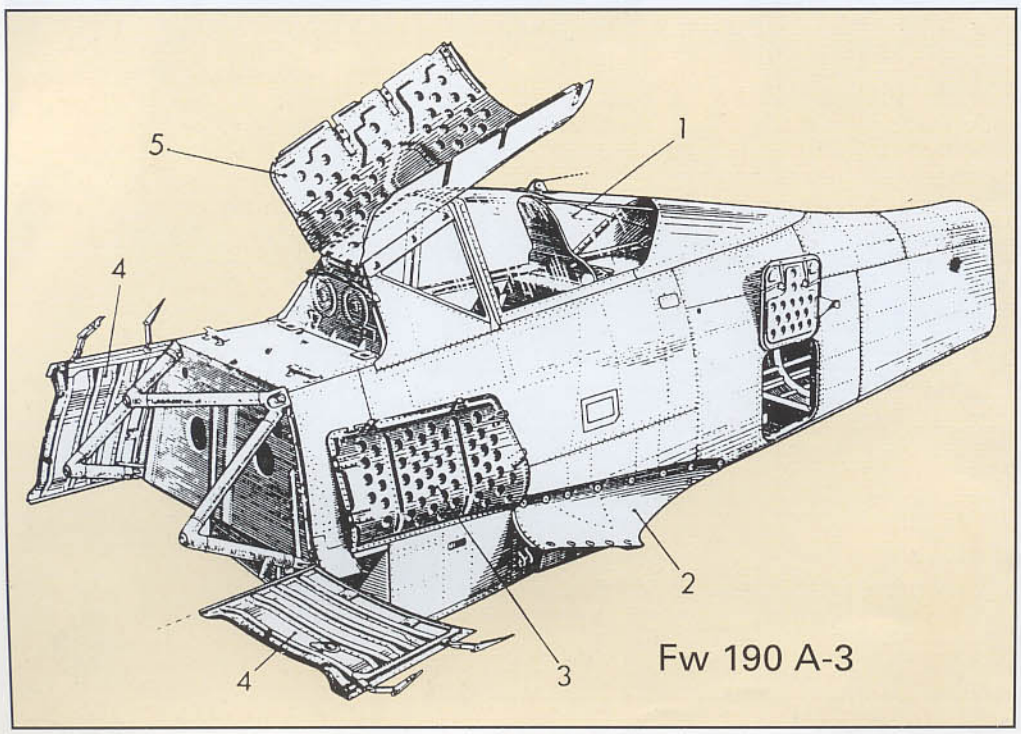
Above: A brand new Fw 190 A-3, W.Nr. 471, KO+PS, photographed on June 1, 1942. Note that at the time this photograph was taken, the pilot's shoulder and head armor plate had not been installed.

Left: One of 72 Fw 190 Aa-3 (lower case a = ausland/foreign) aircraft exported to Turkey under the code name Hamburg. These aircraft were similar to the standard *Luftwaffe* fighter apart from their weapons (4 x MG 17s + 2 x MG FF/Ms) and single radio (FuG 7a).

Opposite right: An overall view of the cockpit of the Fw 190 A-3 piloted by Arnim Faber. Placement of the instruments was generally similar to the A-1 series (see p. 107), but with some minor repositioning. The top row of instruments, from left to right, include the altimeter, the air speed indicator, the turn and bank indicator, the repeater compass, the supercharger boost gauge and the tachometer.

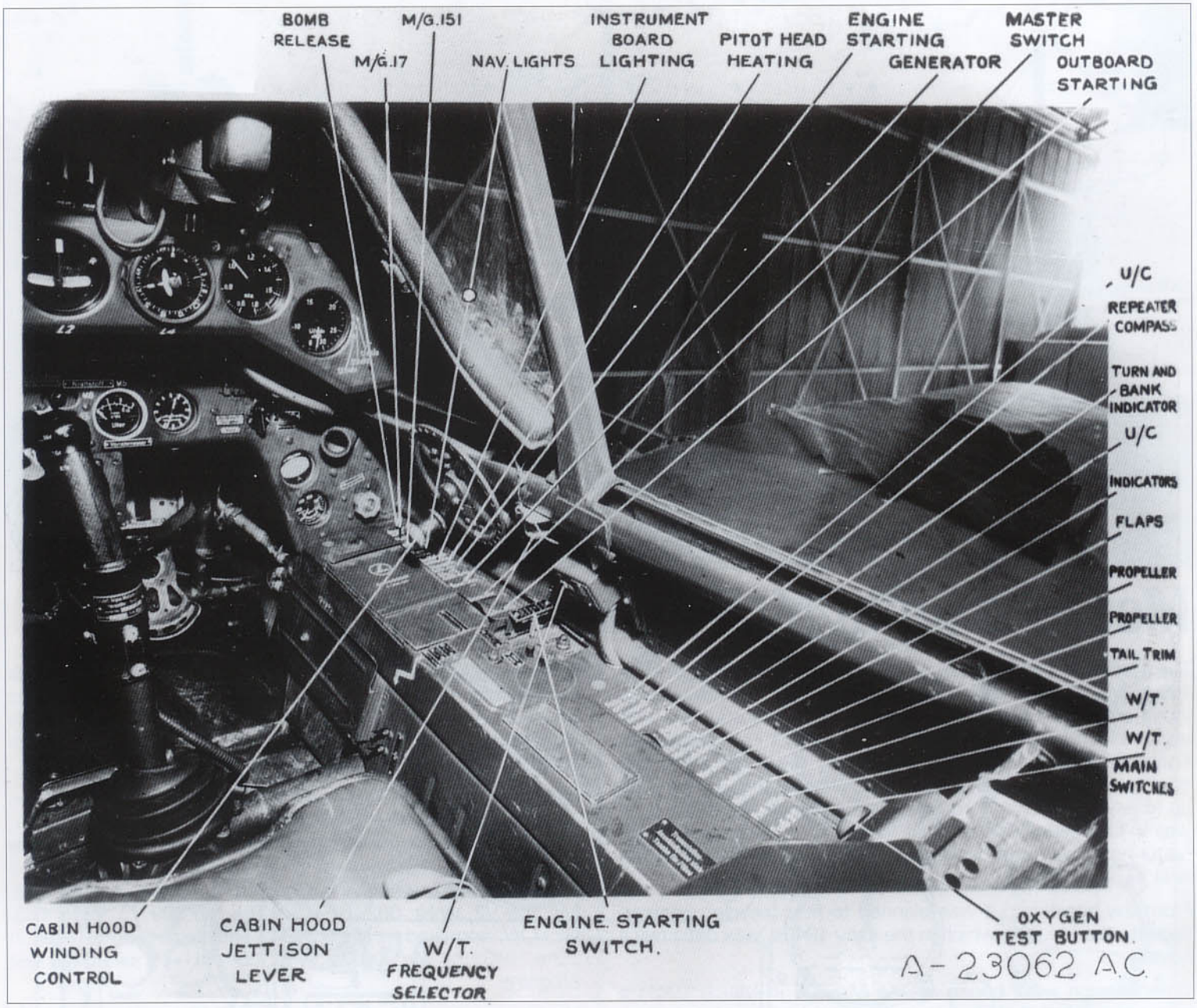






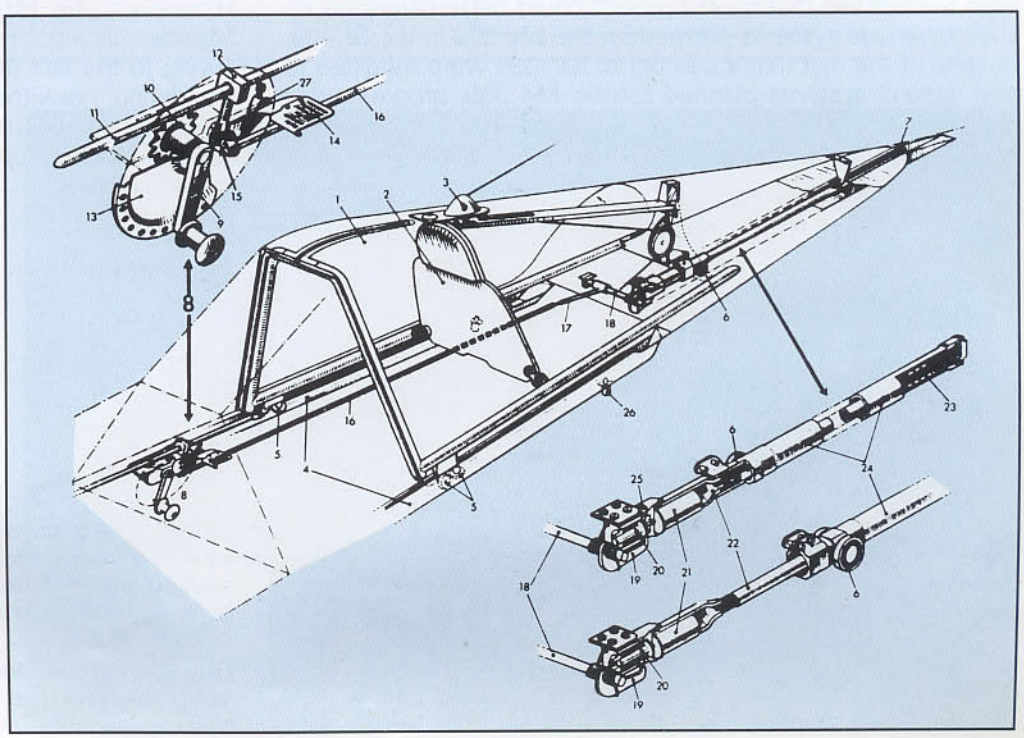
Above and above opposite: Overall views of the port and starboard sides of the cockpit of Arnim Faber's aircraft. Faber's Fw 190 A-3, W.Nr. 313, CM+CL, was captured intact on June 23, 1942 when he made a navigational error and landed by mistake at RAF Pembrey. It was thoroughly examined and test flown for a total of 12 hours 15 minutes before being tested to destruction.

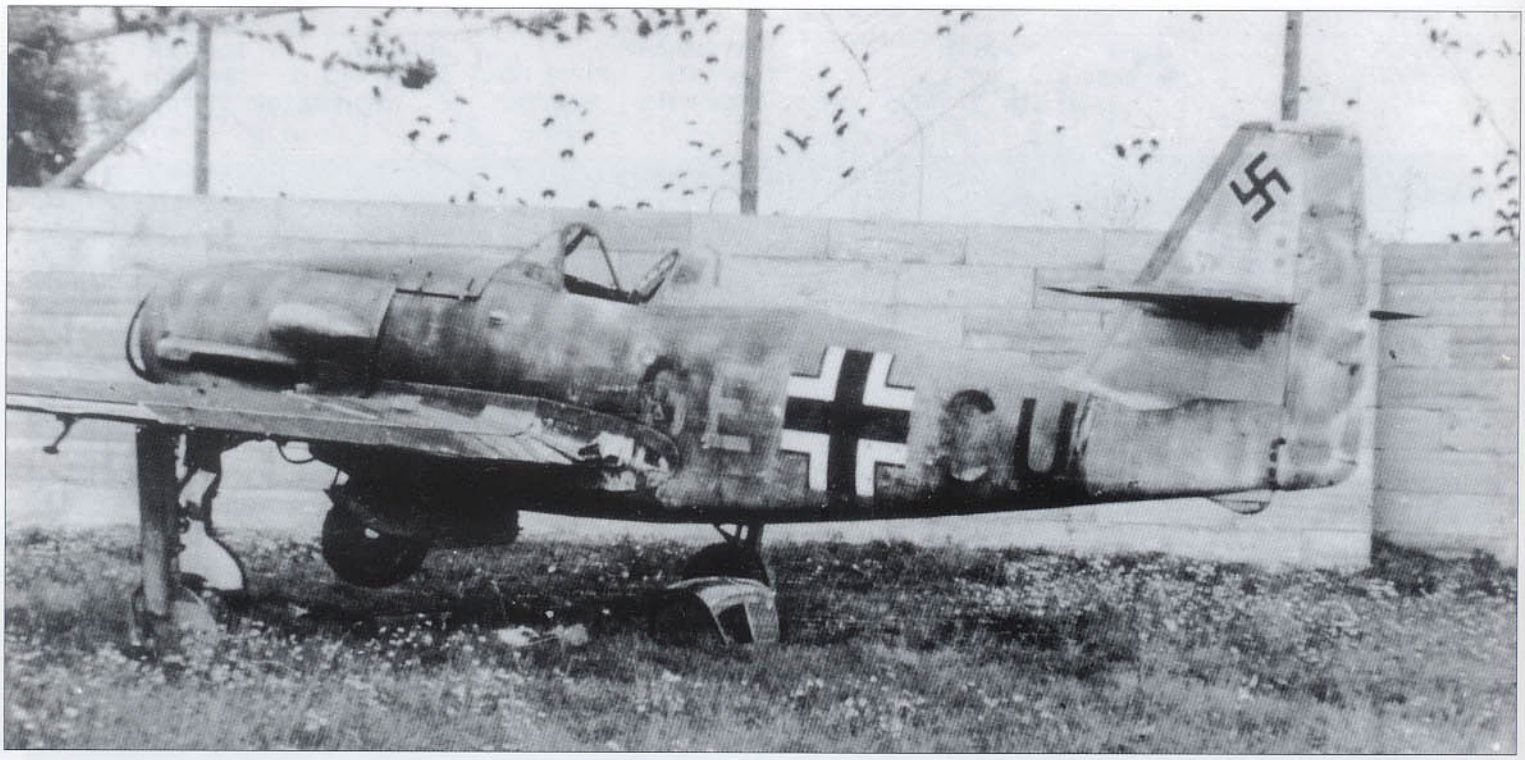
Opposite right: This handbook illustration describes the canopy and its retraction system. A interesting feature of Fw 190 canopies is the method devised to allow the canopy to slide aft on non parallel tracks. Normally, as the canopy moved aft, flexing of the clear Plexiglas would occur at the top front when the two side tracks attepted to converge. To overcome this, Focke-Wulf engineers installed a short length of piano hinge to the top center of the canopy allowing the flexing to be transmitted to the hinge thereby relieving pressure on the Plexiglas.



Canopy Jettison Mechanism

1. Hand crank
2. Canopy drive section
3. Handle
4. Circular plate
5. Jettison lever
6. Pinion wheel
7. Jettison mechanism actuation rod
8. Actuating lever
9. Rotating shaft
10. Safety pawl
11. Firing pin
12. Explosive charge
13. Outer tube
14. Inner firing tube
15. Rollers
16. Upper decking channel section
17. Safety screw
18. Screw cap
19. Canopy guide rollers
20. Bushed strut





Messerschmitt Me 309 V1

The Messerschmitt Me 309 was not a development of the Me 109 or Me 209, but instead, it represented a fresh new design incorporating advanced engineering concepts coupled with lessons learned through combat operations. This single-seat fighter was to have been powered by the most advanced engine, featuring variable radiator positioning and armed with up to seven machine guns and aircraft cannon. Additionally, it was to be fitted with a Laminar flow wing, a pressurized cabin featuring greatly improved pilot visibility, and a pilot ejection seat .

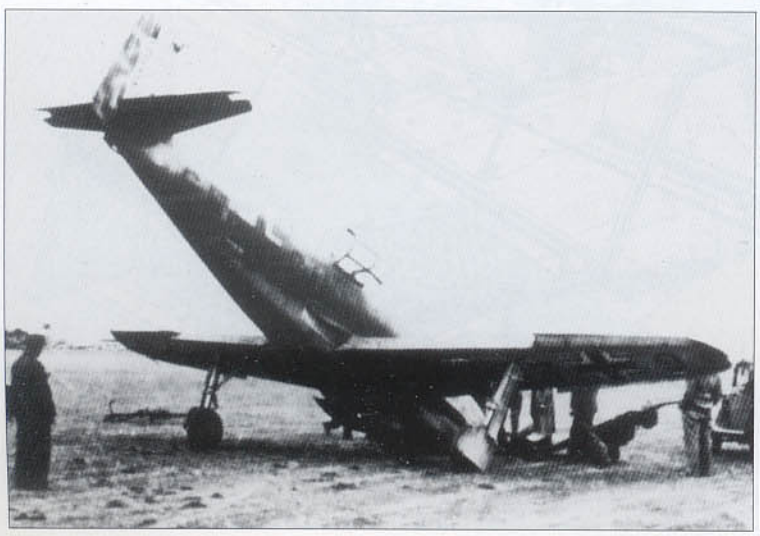
From the beginning, it was planned to fit a tricycle undercarriage to the Me 309, which in the early 1940s, was definitely a novelty.

When design work began on the Me 309 in March 1941, it was anticipated that development could be accelerated by testing various systems planned for the Me 309 in the Bf 109. In spite of the fact that a number of Bf 109s were modified to test various systems planned for the Me 309, progress was decidedly slow, owing in part to Messerschmitt's commitment to so many other projects.

From the start, the designated powerplant for the Me 309 was the Daimler-Benz DB 603, but by December 1941, it was decided to also include the Junkers Jumo 213. It was also planned to install the Messerschmitt Me P 6 reversible-pitch propeller to the DB 603-powered variant.

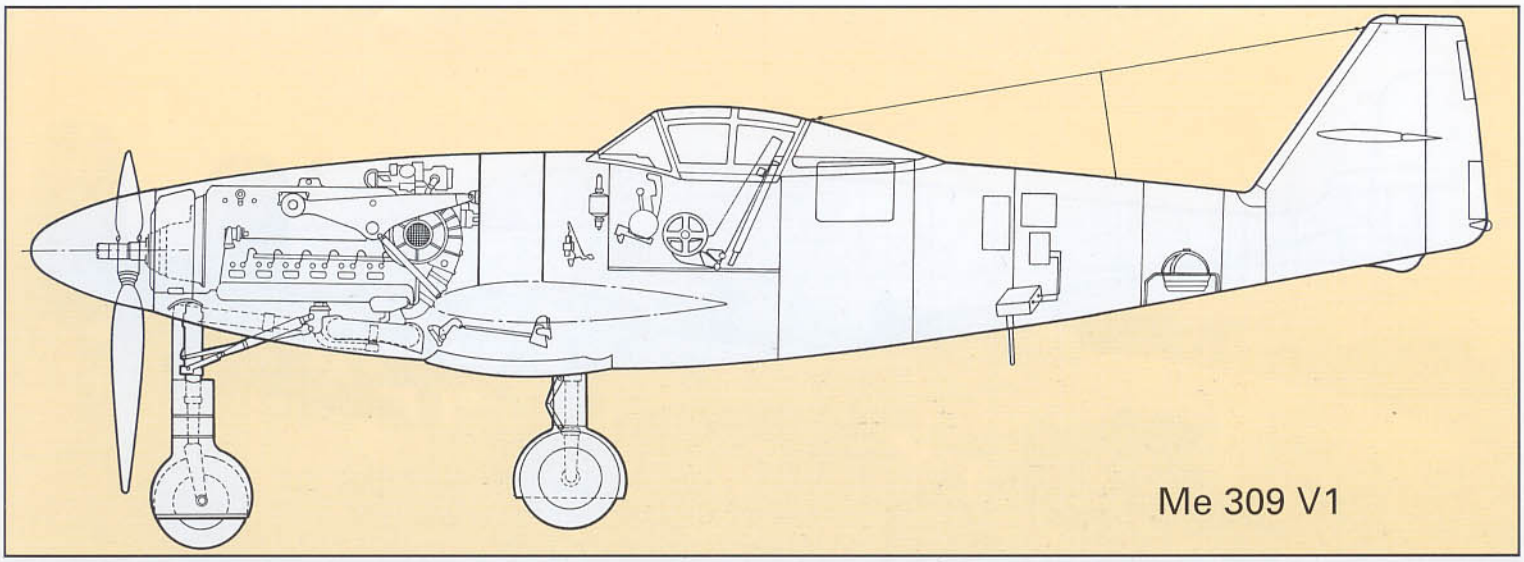
Initially, ten V-machines (test aircraft) were ordered, and on July 18, 1942, the first prototype, the Me 309 V1, W.Nr. 001, GE+CU, was flown for the first time by Messerschmitt test pilot Karl Baur. Testing of the first prototype continued into the autumn of 1942, when it was joined by the second machine, Me 309 V2, W.Nr. 002, GE+CV. The Me 309 V3, W.Nr. 003, GE+CW, appeared in March 1943 and three months later, in June 1943, the Me 309 V4, W.Nr. 004, RH+LH joined the test program.

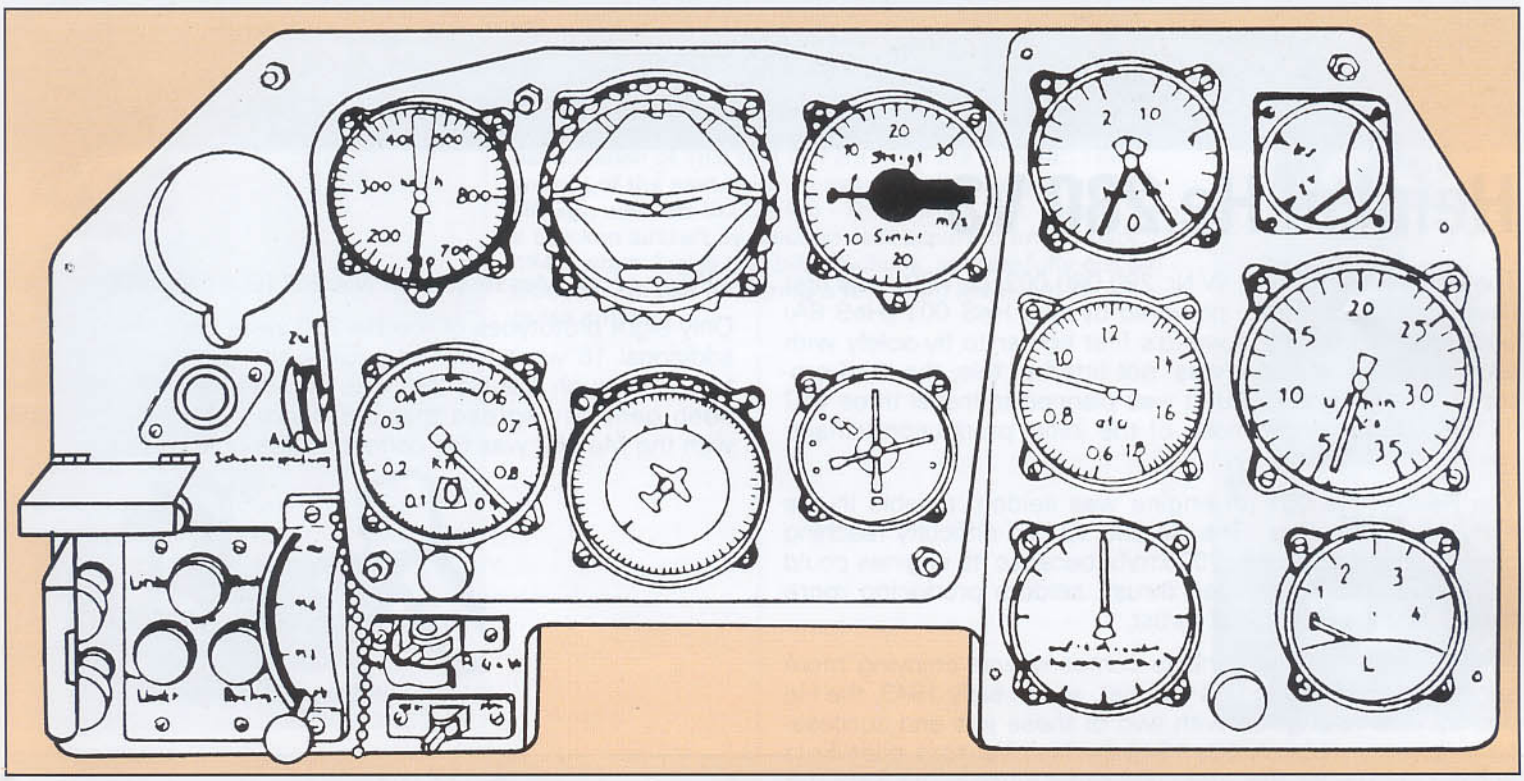
However, by this time (late 1942 to early 1943) Messerschmitt's hopes for the Me 309 had been dashed, owing to the fact that the new fighter's performance was disappointing, notwithstanding the engineering difficulties associated with its unusual features. Officials in the Air Ministry lost interest in the project and no further aircraft of the Me 309 were completed.



Above: The derilect Me 309 V1, W.Nr. 001, GE+CU, discovered by Allied troops after the war. By this time it had been fitted with no less than four different vertical tailplanes. It is shown here with tailplane design 309-36 model Ie with an area of 23.84 ft² (2.215 m²).

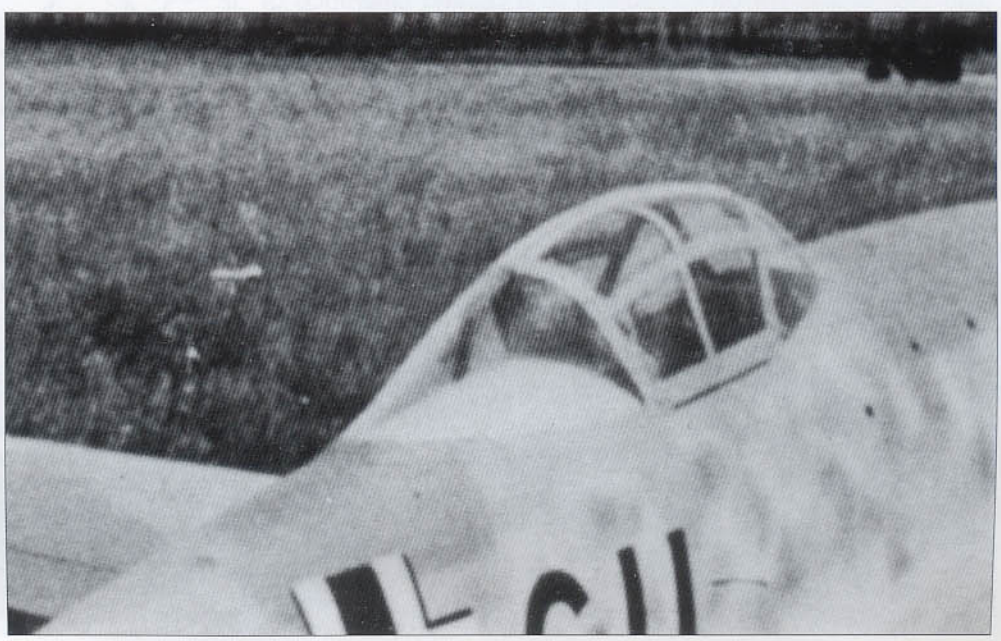
Left: During the 16th flight test, carried out in September, 1942, the nose gear of the Me 309 V1 collapsed upon landing causing relatively minor damage.

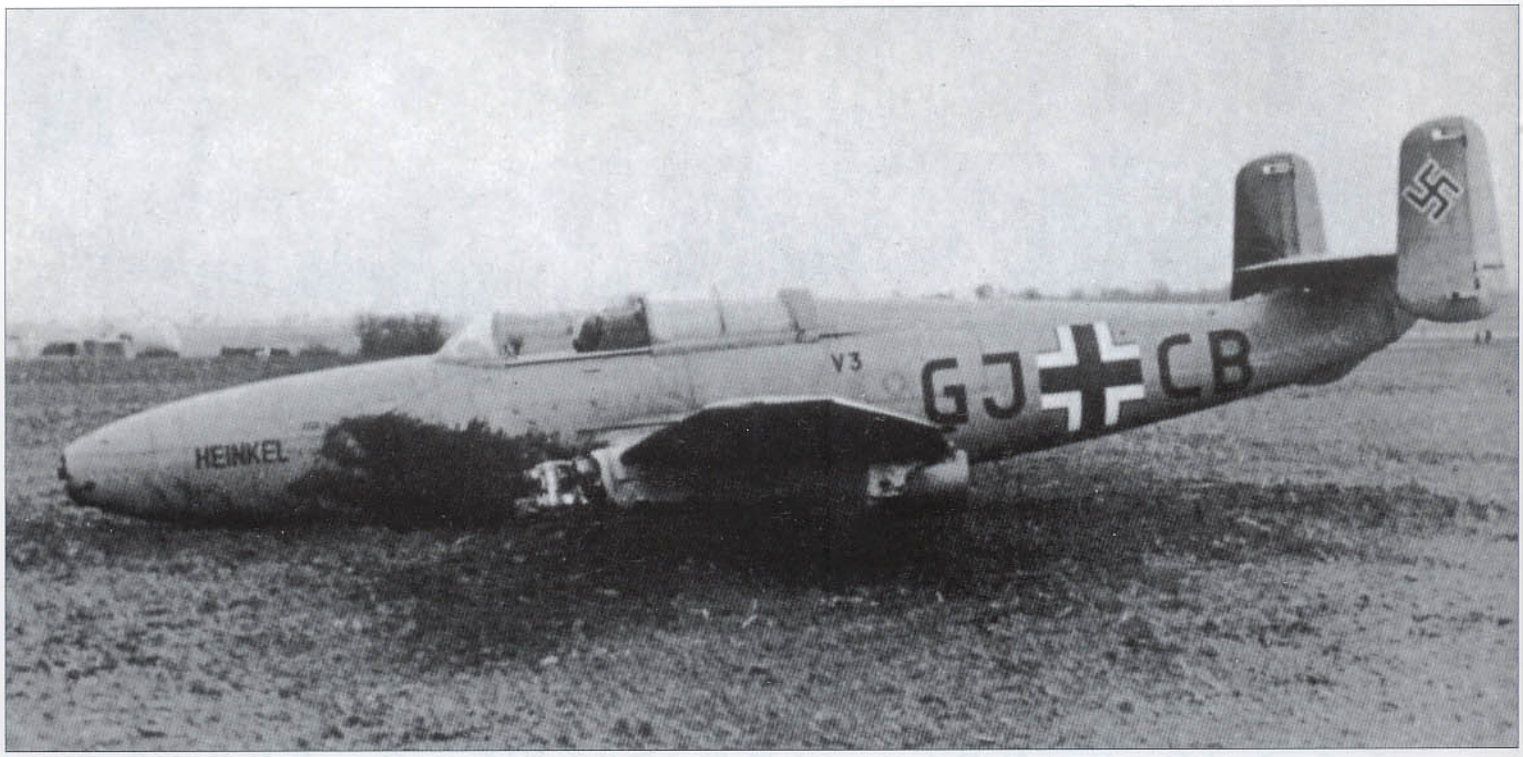




Above: No photographs or complete illustrations of the Me 309's cockpit appear to have survived apart from the right-hand section of the instrument panel containing six instruments. Using this as a basis, combined with established Messerschmitt practice, our reconstruction is undoubtedly quite close to the original design.

Right: A close-up of the cockpit canopy of the Me 309 V1. Typical of most Messerschmitt single-seat fighters, the canopy's center section was hinged to starboard, but could be quickly jettisoned in an emergency.





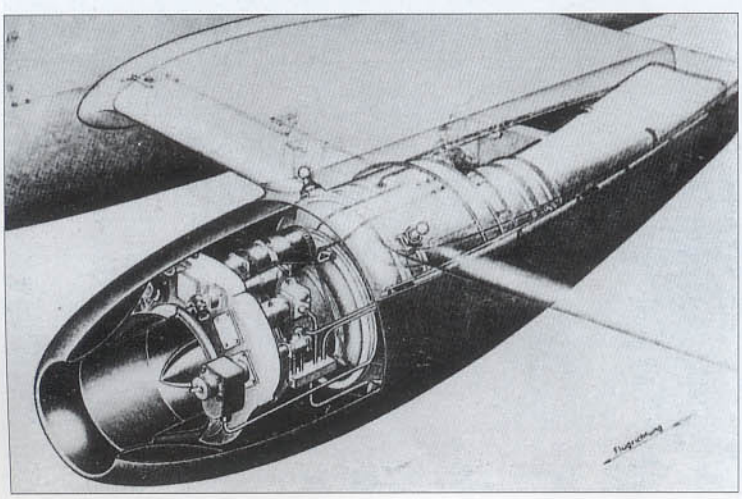
Heinkel He 280 V3

The Heinkel He 280 V3, W.Nr. 280 000 003, GJ+CB, was first flown on July 5, 1942 powered by two HeS 001 (HeS 8A) turbojets, making it the world's first fighter to fly solely with jet engines. Armament was not fitted to this, the third prototype of the He 280, but it was planned to install three MG 151/20 cannon in the nose of the initial production variant, the He 280 A-1.

The Heinkel He 001 jet engine was seldom reliable in the early days of testing. The He 280 V3 had difficulty reaching speeds above 435 mph (700 km/h) because its engines could not deliver the anticipated thrust, seldom producing more than 1,102 lbs (500 kg) of thrust.

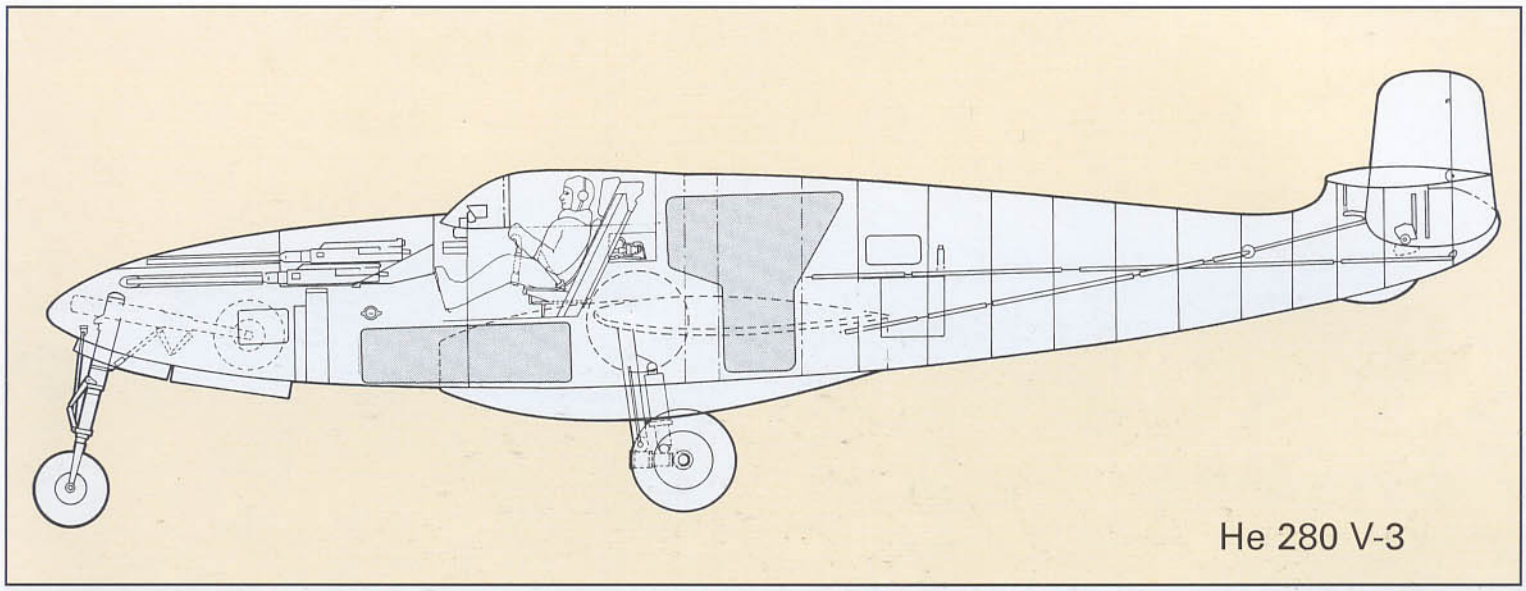
In the meantime, the Junkers company was enjoying more success with its Jumo 004 turbojet, and in early 1943, the He 280 V2 was re-engined with two of these jets and successfully flown on March 16, 1943 by Heinkel test pilot Fritz Schäfer. However, the Jumo 004 had a much larger diameter than that of the He 001, resulting in a ground clearance of only a few inches. This, coupled with undesirable stability problems encountered at high speed with the Jumo engines, resulted in the Air Ministry dropping development of the He 280 in favor of the Messerschmitt Me 262 (see page 158).

Only eight prototypes of the He 280 were completed, but an additional 16 were planned prior to the program's cancellation. Although the He 280 was an advanced design, it has been generally agreed that the decision to move forward with the Me 262 was the correct course of action.

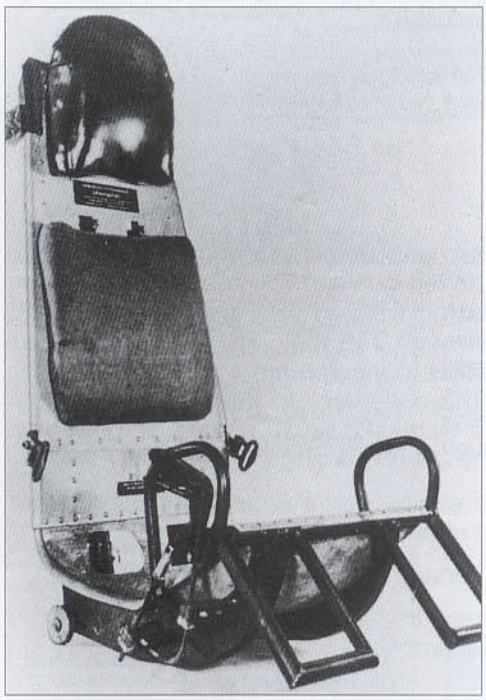


Above: On February 8, 1943, a turbine blade in the starboard engine of the He 280 V3, W.Nr. 003, GJ+CB, broke off just after takeoff. Seconds later a severe vibration occurred followed by a long stream of flame pouring from the engine. The pilot, Fritz Shäfer, quickly shut down the bad engine and, as the prototype began to loose height, he bellied in on the nearest piece of flat ground. Three days later, after repairs had been completed, the aircraft was back in the air performing additional tests.

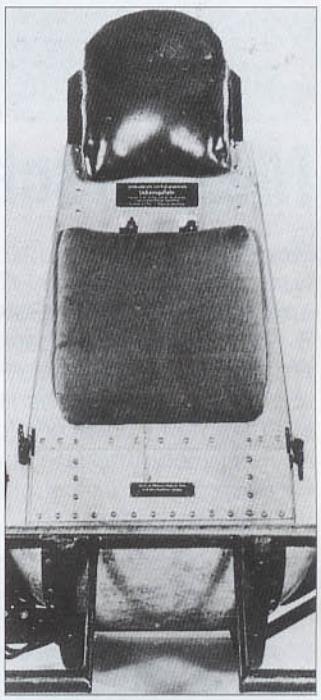
Left: A view of the He 001(HeS 8A) which powered the He 280 V3. This engine was a one-stage centrifugal flow compressor type with a one-stage turbine, which was supposed to develop 1,543 lb (700 kg) thrust at 13,500 rpm, but in fact it rarely produced more than 1,102 lb (500 kg) thrust. The complete unit measured 7.8 feet (2400 mm) in length. Owing to their disappointing performance, only about thirty of these early turbojets were produced.

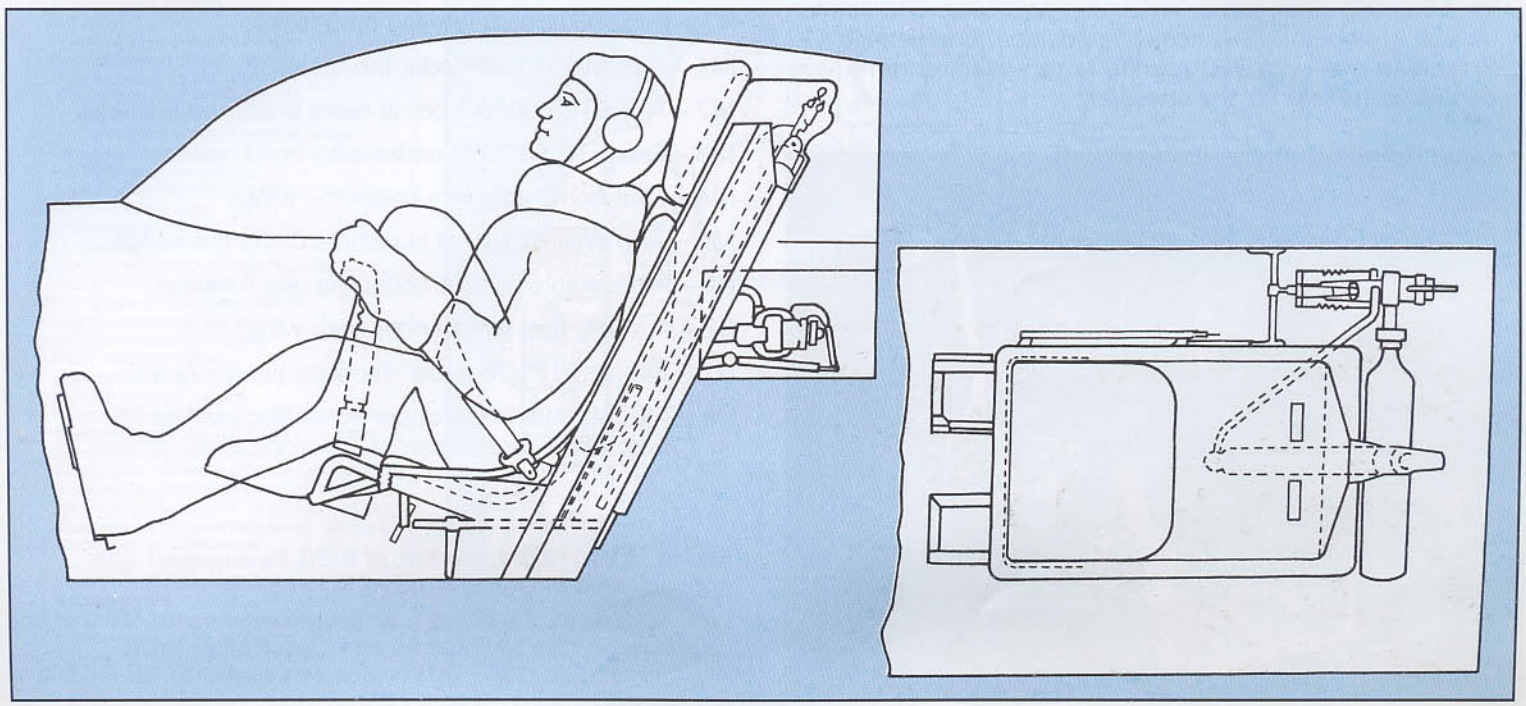


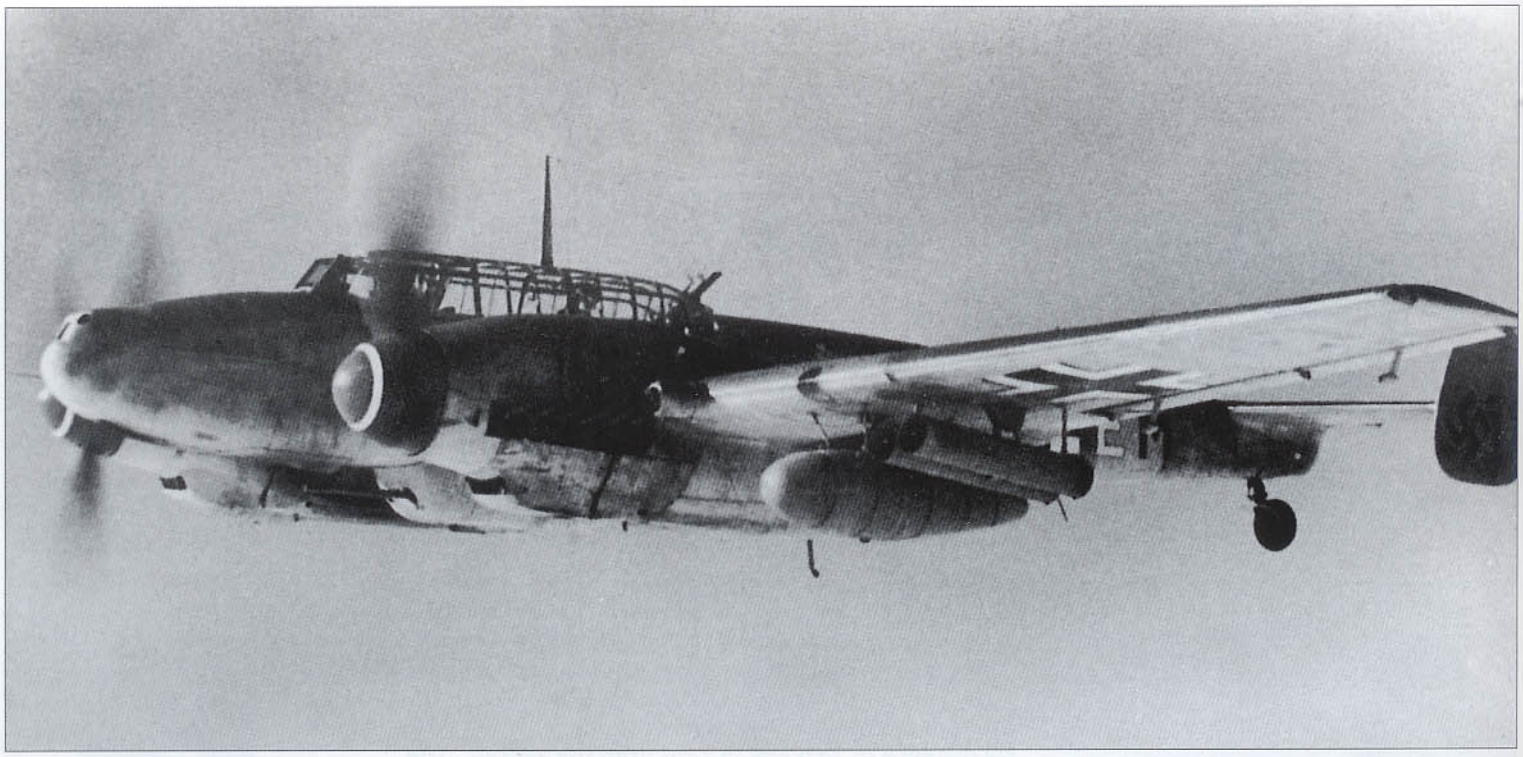
He 280 V-3



Left, right and below: Heinkel was a pioneer in the development of the aircraft ejection seat. Development of this device occurred between June 15 and November 7, 1940 using compressed air to propel the seat with pilot a vertical distance of 18.6 feet (5.7 m) from the aircraft. The weight of the seat, with an average pilot weighing 176 lb (80 kg), was 265 lb (120 kg). The world's first escape from a stricken aircraft by ejection seat occurred on January 13, 1943, when Argus test pilot Schenk successfully ejected from the He 280 V1 during a test flight involving Argus pulse engines.





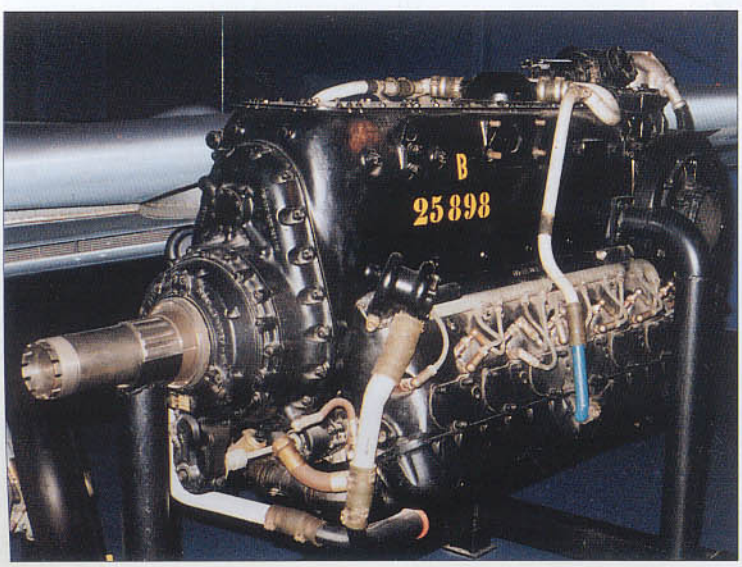


Messerschmitt Bf 110 G-2

Production of the Bf 110 G-2 began late in 1942, with the first examples going to I./ZG 1 based at Shackty, near Rostov on the Eastern Front. Powered by two Daimler-Benz DB 605 B-1 engines driving metal, three-bladed VDM 9-12078 A/B propellers, the new Zerstˆrer version of the Bf 110 was outwardly similar to the earlier F-series, but featured a number of refinements. The cockpit greenhouse structure was modified to accommodate the thicker bullet-resistant armored windscreen, while the pitot tube was relocated to the wing tip's leading edge.

Radio equipment remained identical to that carried by the Bf 110 F-2 and was comprised of FuG X medium-high frequency radio, FuG 25 identification-friend-foe (IFF), Peil G.V direction finding, and FuBl 12F radio landing system.

Armament initially consisted of four MG 17 machine guns with 1,000 rpg in the upper nose, and two MG FF/M cannon with 180 rpg in the lower nose. In addition, one flexible MG 15 machine gun with 750 rounds in ten saddle drums was mounted in the rear for the observer.



The cannon armament was up-graded to two MG 151/20 with 400 rounds for the left gun and 350 rounds for the right, while a flexible rear-facing weapon was changed to the MG 81Z twin machine gun with 750 rpg. The rear canopy was streamlined and modified to incorporate a sideways opening section for entry by the observer. In the rear, the Flettner rudder trim tabs were increased by 30 percent to offset the increased torque of the DB 605 during single-engine flight.

The Bf 110 G-2 was eligible for a wide range of optional equipment depending upon its mission. These included:

R1 – One BK 3.7 flak cannon mounted under the fuselage.

R3 – Two MK 108 cannon in the upper nose (was U9 modification).

R5 – R1 plus R3.

R7 – Two 300 litre underwing drop tanks.

M1 – Two MG 151/20 under the fuselage.

M2 – Two ETC 500/ IXb bomb racks under the fuselage.

M3 – Four ETC 50/ VIIId under-wing bomb racks.

M4 – Four bomb adapters under the wings.

M5 – Two WGr 42 rocket launchers under the wings.

B1 – Jettisonable oil tank under the rear fuselage.

B2 – Auxiliary fuel tanks under each wing.

U1 – Two MG 151/20 under the nose firing forward.

U9 – Two MK 108 in the upper nose. Reclassified R3.

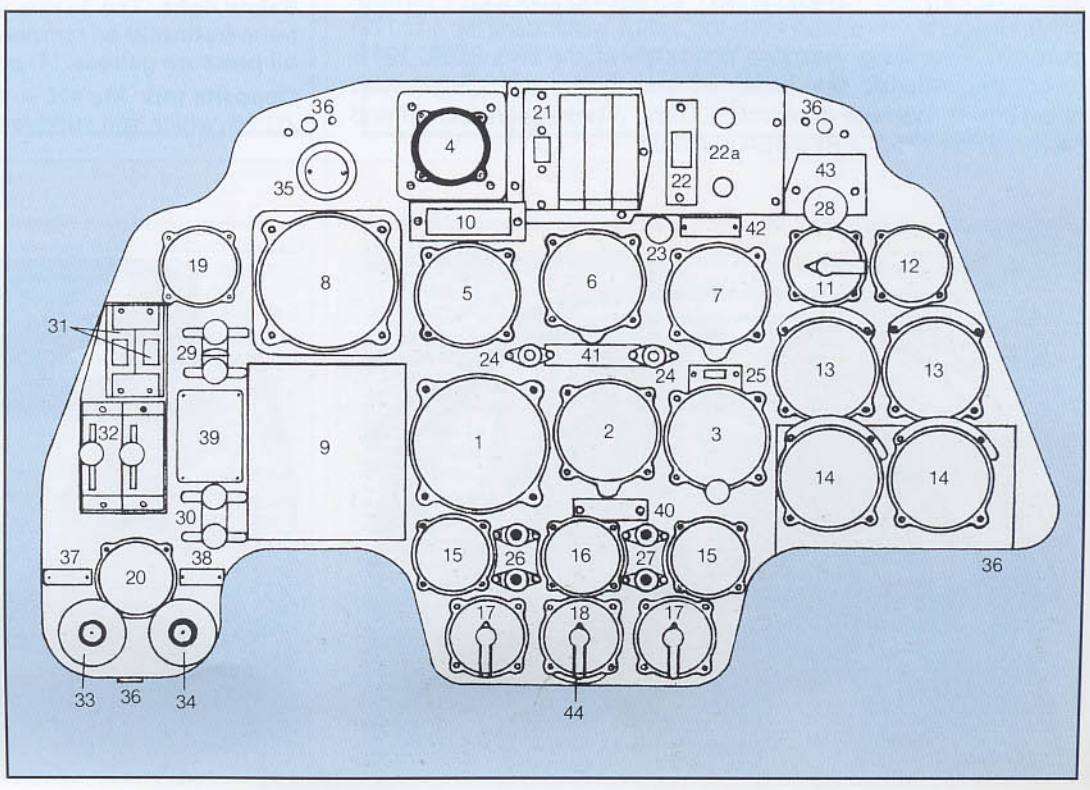
tp or trop - *Tropenausrüstung* (tropical equipment).

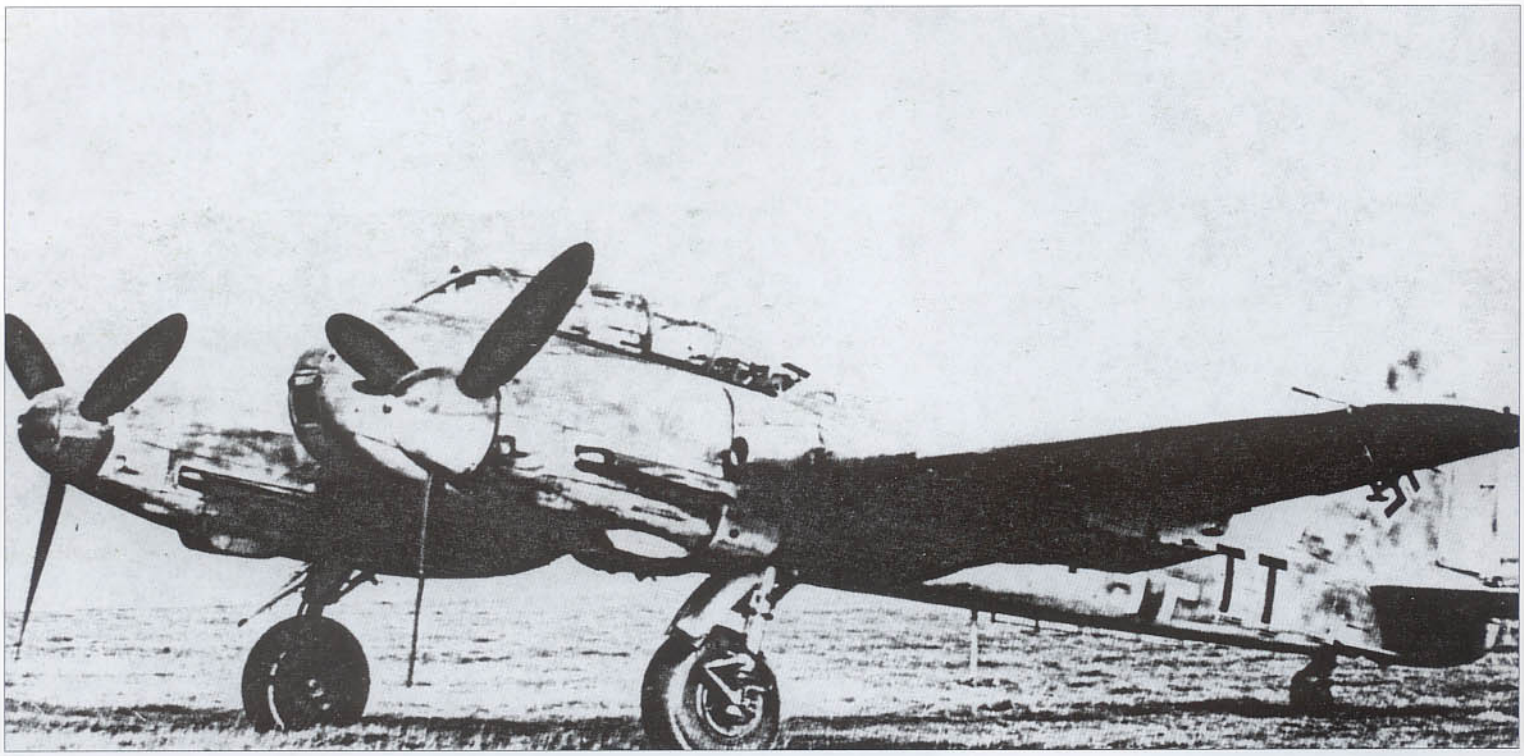
Above: A Bf 110 G-2, 2N+EM, of II./ZG 76, equipped with optional equipment packs R3,R7,M1 and M5.

Left: A view of a DB 605 B-1, which powered the Bf 110 G-2, on display within the National Air and Space Museum in Washington, DC, USA. This engine was similar to the DB 605 A-1 but with a different gear ratio.

1. Artificial horizon integrated with turn and bank indicator
2. Airspeed indicator
3. Altimeter
4. AFN 2 homing indicator
5. Turn and bank indicator unless incorporated within item 1 otherwise vacant space was used for other equipment
6. Variometer
7. FuG 101 radio altimeter
8. Repeater compass
9. Auto-pilot
10. Course indicator
11. Main switch for auto-pilot
12. Exterior temperature
13. Tachometers
14. Supercharger boost gauges
15. Coolant temperature gauges
16. Fuel contents gauge
17. Coolant radiator flap position indicators
18. Fuel tank selector switch
19. Undercarriage position indicator
20. Compressed air pressure gauge
21. Nose armament round indicators
22. Cocking switch for MK 108
22a. Round indicators for Rüstatz M1
23. Windscreen heating indicator
24. Fuel tank selector switch warning lamps
25. Pitot tube heating switch
26. Port low fuel warning lamp
27. Starboard low fuel warning lamp
28. Cockpit heating knob
29. Undercarriage controls
30. Landing flap controls
31. Mech. or auto propeller pitch controls
32. Prop pitch control levers
33. Emergency undercarriage switch
34. Emergency landing flap switch
35. Emergency auto-pilot switch
36. Panel attachment points
37. Gear identification placard
38. Flap identification placard
39. Warning placard: Achtung Fahrwerk bei Geschwindigkeitüber 400 km/St nicht betätigen (Attention: do not operate gear at a speed above 249 mph) Achtung: Landeklappe muss bei Geschwindigkeit ‚ber 250 km/St vollständig eingefahren sein (Attention: Landing flaps must be retracted fully above 155 mph)
40. Warning placard: Maximale Sturzfluggeschwindigkeit 700 km/h (Maximum diving speed is 435 mph)
41. Position plate for tank selector switch
42. Function plate for windshield heating
43. Function plate for cabin heating
44. Position plate for tank selector switch

Above: The instrument panel shown above and the illustration below are typical of the ones used by the Bf 110 G-2 series. There were many variations within this basic format. The installation of new equipment to operational aircraft was a common occurrence in addition to aircraft returned from the front for reconditioning. The basic panel was available in metal or wood. The metal panel was fabricated from 3 mm sheet aluminum while the wooden version was made from 15 mm Beech veneer.





Messerschmitt Me 410 A-1/U2

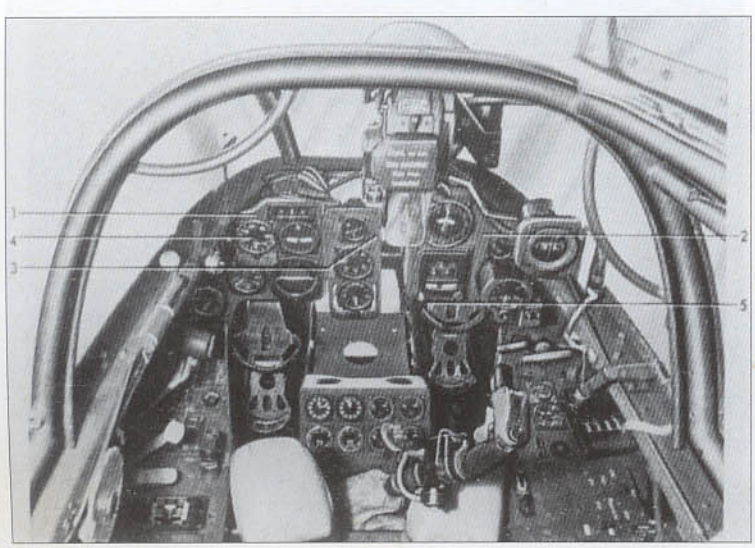
Appearing in January 1943, the Me 410 A-1, powered by two Daimler-Benz DB 603 A engines, was a direct development of the Me 210 A-1(see p. 110) which it closely resembled apart from the engines. The Me 410 was the culmination of an exhaustive testing program designed to eradicate the many shortcomings of the basic Me 210 design. Classified as a *Zerstörer,* or heavy fighter, the Me 410 A-1/U2 retained the Me 210 A-1 armament which included two forward-firing MG 17 machine guns with 1,000 rpg, plus two MG 151/20 cannon, each with 350 rpg. But, in addition to these weapons, the special modification known as U2 (*Umrüst-bausätze* / Modification construction set 2) could be fitted within the internal bomb bay. This installation was comprised of two cylindrical containers, each with a 20 mm MG 151/20 cannon containing 250 rpg, Forward-firing weapons were fired with the aid of a standard Revi C 12D gunsight. Rear-firing weapons consisted of the two FDSL 131B remotely-controlled side-mounted gun turrets each fitted with one 13 mm machine gun with 500 rpg. These were aimed and fired with the aid of a Revi 16A gunsight.

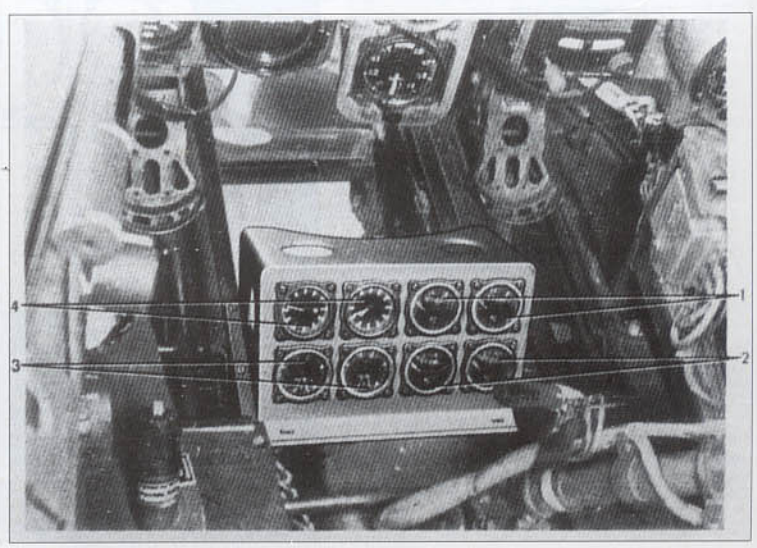
Above: A standard production Me 410 A-1/U2, ??+TT, prior to delivery to an operational unit.

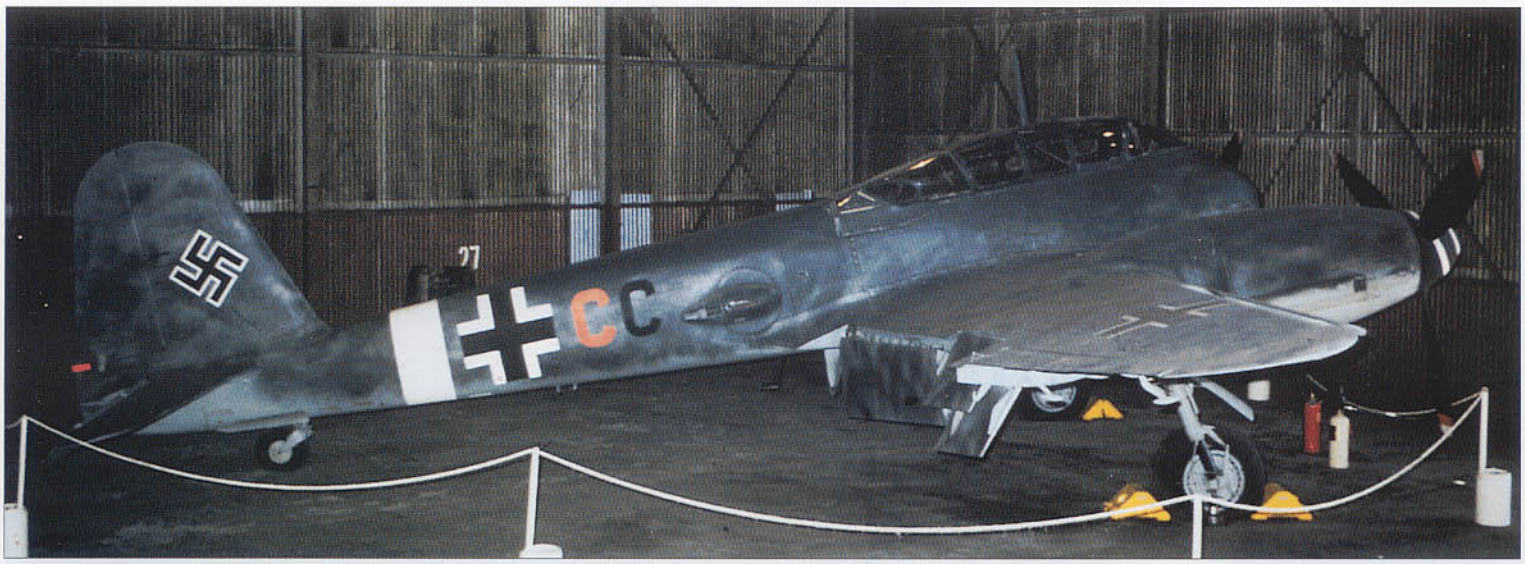
Below left: A view of the front cockpit showing the bifurcated main instrument panel layout. On the left panel (1) are the Kurs course indicator, (4) air speed indicator, turn and bank indicator, two tachometers (one to the lower left) and the artificial horizon. The auxiliary panel (3) holds an AFN-2, variometer and the altimeter. The right hand panel (2) has a Patin repeater compass with a combined directional gyro compass and slip indicator below. A fuel gauge can be seen tucked in behind the stand by the magnetic compass in its separate frame mounting on the right edge of the panel. Top center is the Stuvi 5B periscopic dive-bombing sight. Note the bulged canopy above it.

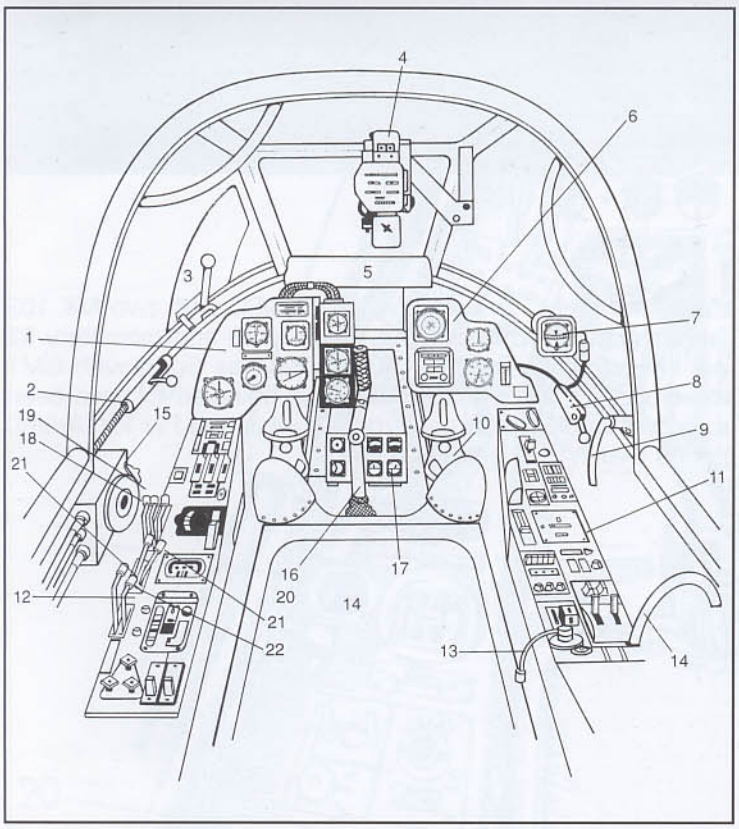
Below right: The auxiliary panel detail showing (1) coolant temperature(2) oil temperature gauges, (3) combined fuel and oil pressure gauges, (4) propeller pitch indicators.

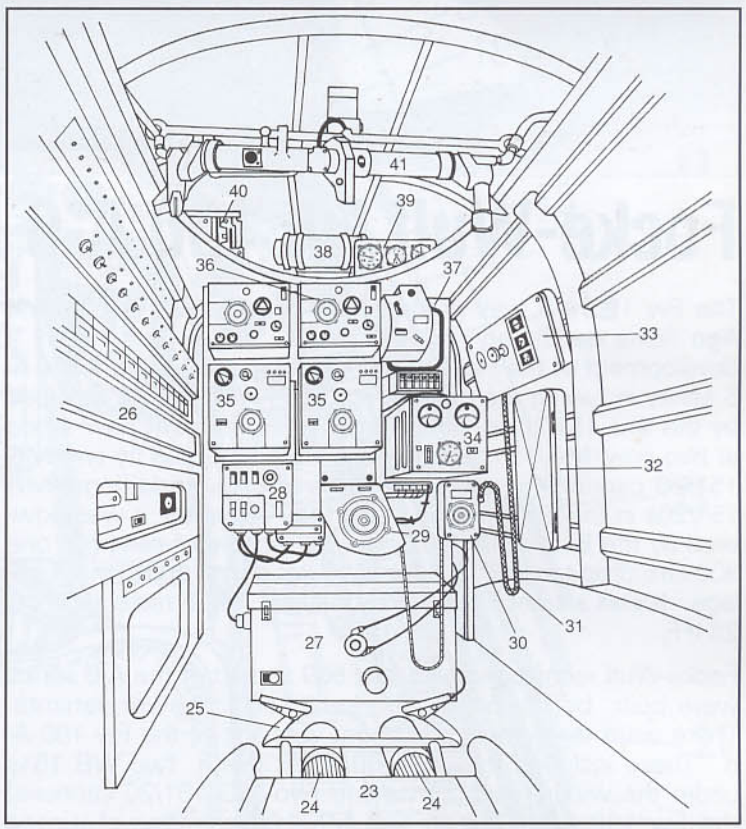
Opposite top: Me 410 A-1/U2, W.Nr. 420430, PD+VO, 3U+CC of ZG 26 which still survives in Britain.











Me 410 A-1 Forward Cockpit

1. Left instrument panel containing left to right: (top) supercharger boost pressure gauge, airspeed indicator; (bottom) tachometer, Patin auto-pilot, turn and bank indiator
2. Tail wheel castor lock
3. Clear vision panel
4. Revi C 12D gunsight or Stuvi 5B bombsight
5. Center instrument panel containing, top to bottom: AFN 2 homing indicator, variometer, altimeter
6. Right instrument panel containing left to right: repeater compass, course indicator, external temperature gauge, altimeter
7. Magnetic compass
8. Cabin heater conrol
9. Canopy jettison handle
10. Rudder pedals
11. Starboard console contraining, front to rear: bomb release handles, bomb pattern selector switch and test lamp, bomb release selector switches and circuit test lamps, Oxygen flow indicator, oxygen indicator, FuG 16 control unit, bomb fusing panel, internal lighting control, oxygen supply line
12. Port console containing, front to rear, armament switch and round counters, coolant radiator flap controls, generator warning lamps, emergency electrical supply selector, ignition switches, Patin course change selector, central warning panel, undercarraige, flap, dive brake, bomb doors, selector box, emergency engine cutout handles. emergency gear, flaps, bomb doors controls, engine starter switches
13. Pilot's headset connection
14. Pilot's seat
15. Rudder, aileron, elevator trim tab control
16. Control column
17. Lower instrument panel containing: prop pitch indicators, coolant temperature gauges, fuel + oil pressure gauges, oil temperature gauges
18. Throttles
19. Prop pitch controls
20. Main fuel control cock
21. RPM corrector levers
22. Engine isolating levers
23. Crewmanís seat

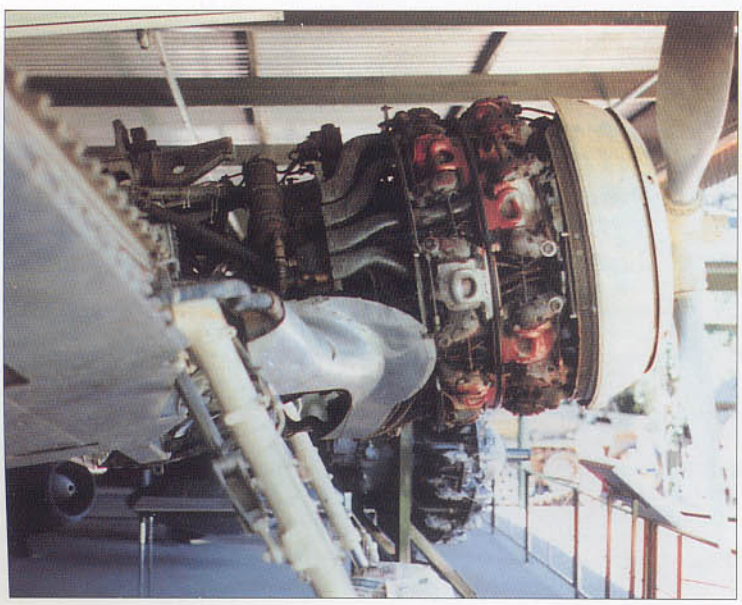
Me 410 A-1 Rear Cockpit

24. Gas mask containers
25. Foot rests
26. Main electrical distribution panel
27. EZ 2 direction finding receiver
28. FuG 10 switch box
29. Radio direction finding indicator
30. AFN 2 homing indicator
31. Oxygen supply tube
32. Signal flare box
33. Oxygen supply panel
34. FuG 10 control and selector unit
35. FuG 10 transmitter
36. FuG 10 receiver
37. Remote control unit for EZ 2 receiver
38. Radio direction finding control
39. Rear instrument panel for clock, altimeter, airspeed indicator
40. LSK 11 master switch and round counter
41. Sighting device for FDSL-B 131/1 rear-firing weapons

Focke-Wulf Fw 190 A-6

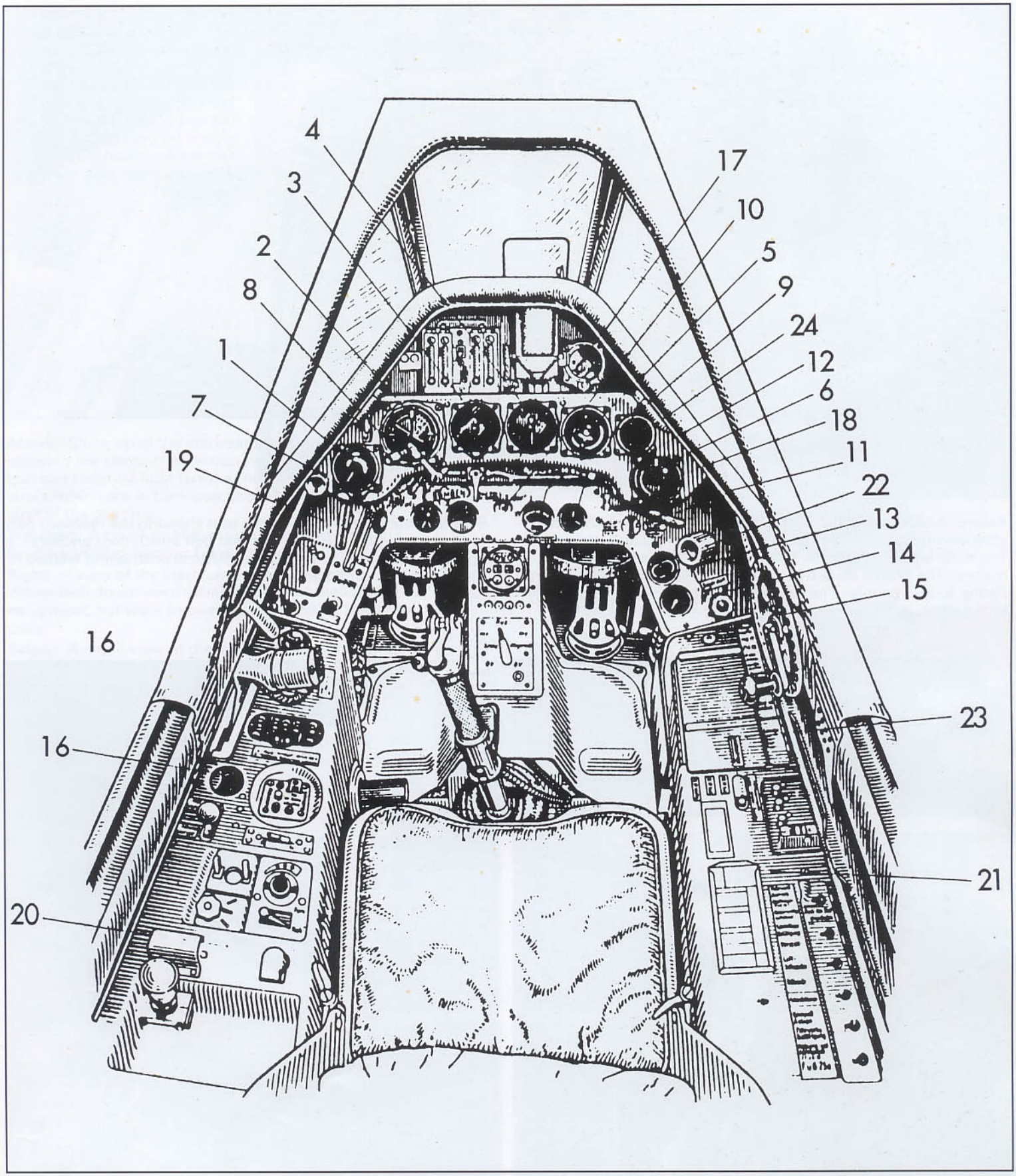
The Fw 190 A-6 was produced by the Arado, Fieseler and Ago firms beginning in June 1943. It was essentially a development of the Fw 190 A-5/U10, but differed from the A-5 series in having the outer-wing MG FF/M cannon replaced by the MG 151/20 cannon. Thus, A-6 armament now stood at two cowl MG 17 machine guns supplemented by two MG 151/20 cannons in the wing roots and two additional MG 151/20s in the outer wings. Like the A-5 series, it was powered by the BMW 801 D-2 and was capable of carrying one 300 litre drop tank or 1,102 lb (500 kg) bomb under the fuselage. It was also equipped with the FuG 16Z-E radio and FuG 25 IFF.

Focke-Wulf records indicate that 569 aircraft of the A-6 series were built before production switched to newer variants. There were three main armament versions of the Fw 190 A-6. These included the Fw 190 A-6/R1 with two WB 151s under the wings, each containing two MG 151/20 cannons; the Fw 190 A-6/R2 with two MK 108 cannons mounted under the wings; and the Fw 190 A-6/R3 with two MK 103 cannons mounted under the wings with approximately 32 rpg. In addition, the Fw 190 A-6/R4 was fitted with GM1 powerboost. The Fw 190 A-6/R5 is believed to have been equipped with MW 50 powerboost, while the Fw 190 A-6/R6 carried two WGr. 21 rocket tubes.



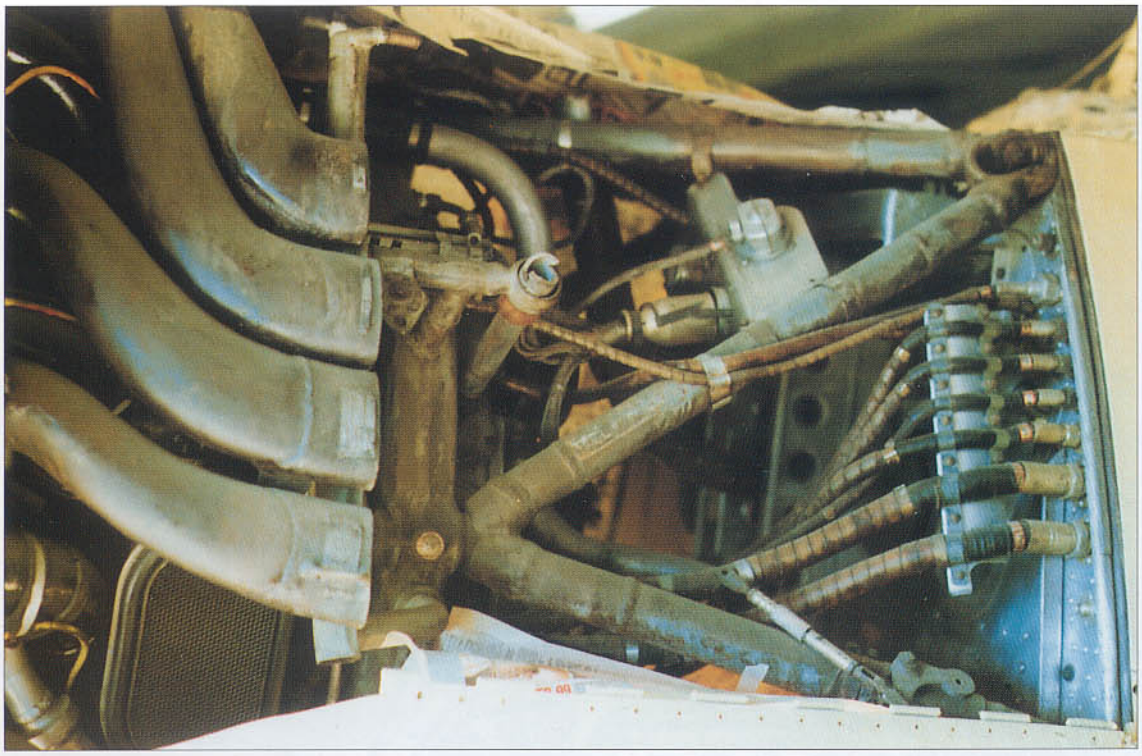
Above: This Fw 190 A-6/R2, W.Nr. 550214, PN+LU, has been fully restored by the staff of the Museum of Military History at Saxonwold, South Africa. According to museum records, the aircraft was originally to have been fitted with two underwing WGr. 21 rocket tubes (as an R6 fitting), but these were never installed. Instead, two underwing MK 108s (as an R2 fitting) were apparently substituted, or were to be substituted. In addition, this example was at one time fitted with the so-called *Neptun Lilliput*, a form of range-finding radar to be used in conjunction with the underwing rockets for attacking formations of American day bombers. The three antennae for the *Neptun Lilliput* were positioned at an angle above each wing. In this configuration it was reportedly attached to *Erprobungsstelle* 8./JG 11. The museum staff decided to apply the unit emblem of this testing and evaluation unit to their aircraft's forward cowling.

Left: A view of the exposed BMW 801 D engine of the South African Fw 190 A-6/R2. Note the bunched exhaust stacks on the engine's starboard side.



Fw 190 A-6

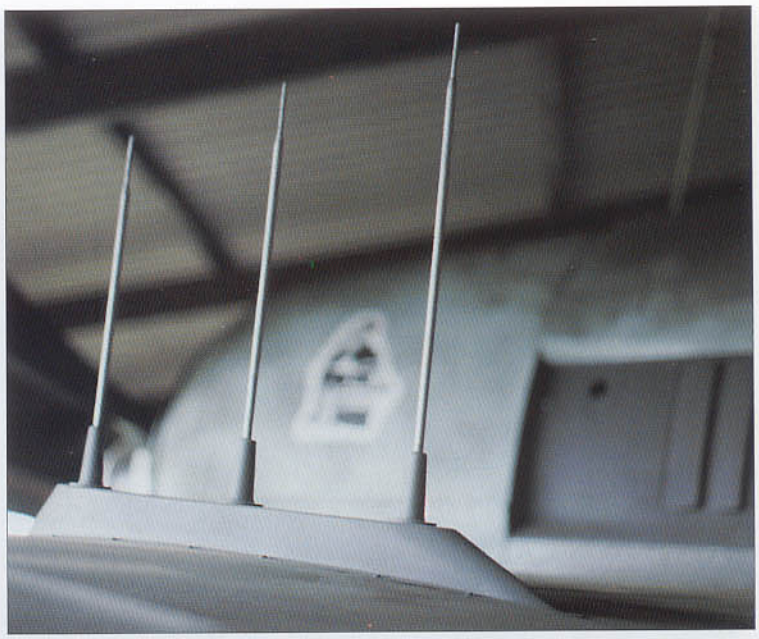
1. Fine and course altimeter
2. Artificial horizon
3. Airspeed indicator
4. Tachometer
5. Repeater compass
6. Supercharger pressure gauge
7. Fuel + oil pressure gauge
8. Oil temperature gauge
9. Fuel contents gauge
10. Low fuel warning light
11. Selector switch for fuel supply
12. Mechanical prop pitch indicator
13. Oxygen indicator
14. Oxygen flow gauge
15. Oxygen flow valve
16. Horizontal stabilizer trim indicator
17. Clock
18. Main instrument panel
19. Secondary instrument panel
20. Left console
21. Right console
22. Signal flare pistol holder
23. Signal flare container
24. AFN 2 homing indicator (FuG 16 ZY)



Left: Close-up detail of the port side exhaust stacks and the tubular engine mounting assembly. Note that each exhaust stack has its own identification plate riveted to the end of each pipe. The top pipe is for cylinder 14, the next two are for cylinder 13 and 12, while the lower pipe serves cylinder 11.

Below: A close-up of the port landing gear with the simulated gondola housing a replica of the MK 108 immediately behind it. The main wheels were size 700 x 175 with 300 mm diameter brakes. The brakes were hydraulically actuated by toe pressure on the rudder pedals. The wheels could be braked individually or together.

Below: Detail view of the pilot's seat showing the recessed pan for the removable cushion, the seat belt attachment anchors and the seat guide mountings for vertical positioning welded to the 8 mm armored back plate.



Above: Close-up of the starboard landing gear leg showing the rotation retraction drum with drive unit (painted Color 02 RLM Gray) connected to the radius struts, which are in turn, connected to the oelo shock strut of the gear leg.

Top right: A close-up of the wing-mounted antenna for the so-called *Neptun Lilliput* range-finding radar.

Right: A view of the starboard wheel well area. Wheel well doors were usually fitted as standard equipment, but were frequently removed by front-line units.

Below: A detail view of the lower fuselage showing the fixed loop homing antenna (incorrectly painted light blue). Note the unpainted rectangular manufacturer's identification tag in the upper right corner, just below the arm of the national aircraft insignia.

Below right: Close-up of the retractable tailwheel with a 350 x 135 tire size. The tailwheel could swivel a full 360 degrees but could be locked in a centered position.

Messerschmitt Bf 109 G-6

Appearing for the first time in June 1943, the Bf 109 G-6 series was produced in large numbers and served on all fronts on which the *Luftwaffe* was engaged. It was a non-pressurized fighter powered by the DB 605 A driving a metal, three-bladed, VDM 9-12087 propeller developing 1,475 hp for take-off.

The principal difference between this fighter and its immediate predecessor (the Bf 109 G-4), rested with its armament. The small- caliber MG 17s which had occupied the top cowl position on so many Messerschmitt fighters since the beginning of the war were finally replaced by the larger 13 mm Rheinmetall-Borsig MG 131 machine gun with 300 rpg. This new weapon system necessitated special bulges atop the rear portion of the cowling in order to accommodate the larger ammunition feed chutes. Additionally, early production G-6s continued to feature the tall radio mast (see pg. 140), but when the R7 equipment (d/f loop) became standard, the new shorter mast was standard.

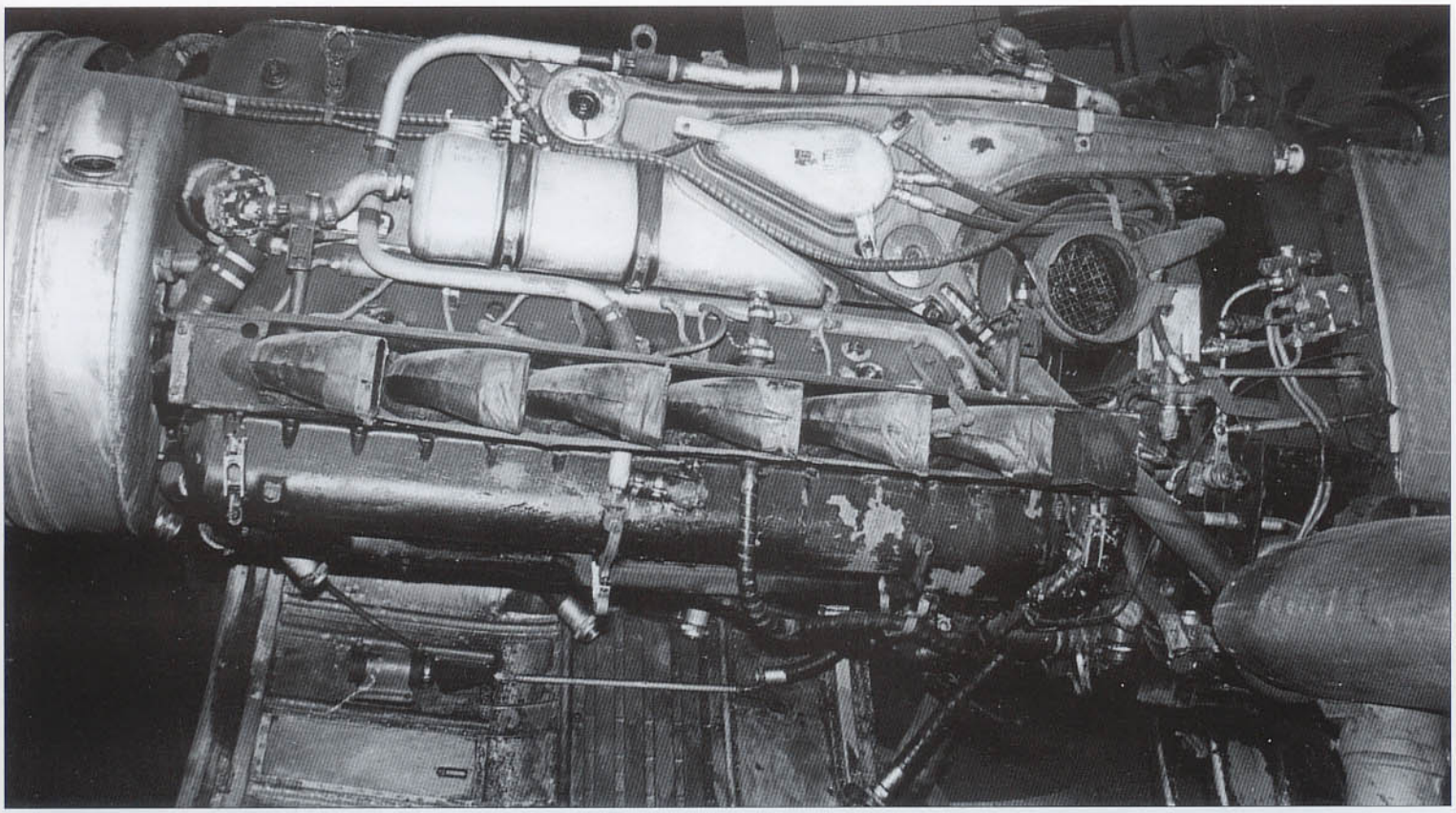
Pilot protection was increased by the addition of the so-called *Gallandpanzer* a bullet-resistant glass mated to thicker armor plating for the canopy hood, as first suggested by Gen. Galland. There also appeared a new one-piece clear canopy known as the *Erla haube* (Erla cover), first manufactured by the Erla firm. This new canopy gradually replaced the older two-piece version, but the transition was gradual. Early in 1944, a new taller vertical tailplane was introduced, initially made of metal, but with later versions entirely made of wood. None of these modifications had any effect upon the aircraft's subtype designation.

The Bf 109 G-6 remained in production for nearly one year and was the subject of numerous modifications designed to improve its performance, firepower or handling. For example, the Bf 109 G-6/AS was powered by the new DB 605 AS engine (see pg 155). The Bf 109 G-6/U1 was a special fighter equipped with the Me P 6 reversible-pitch propeller. The Bf 109 G-6/U2 and U3 respectively denoted the presence of GM 1 or MW powerboosting, while the Bf 109 G-6/U4 exchanged its engine-mounted 20 mm cannon for the 30 mm MK 108. Bf 109 G-6s which were destined for export to Germany's axis partners were identified as Bf 109 Ga-6 aircraft (the lowercase a = *ausland*/foreign). Aircraft equipped with special filters and other items for service in north Africa were identified as Bf 109 G-6/tp or G-6/trop variants.

In addition to the above listed modifications, the Bf 109 G-6 was also eligible for the following auxiliary apparatus items:

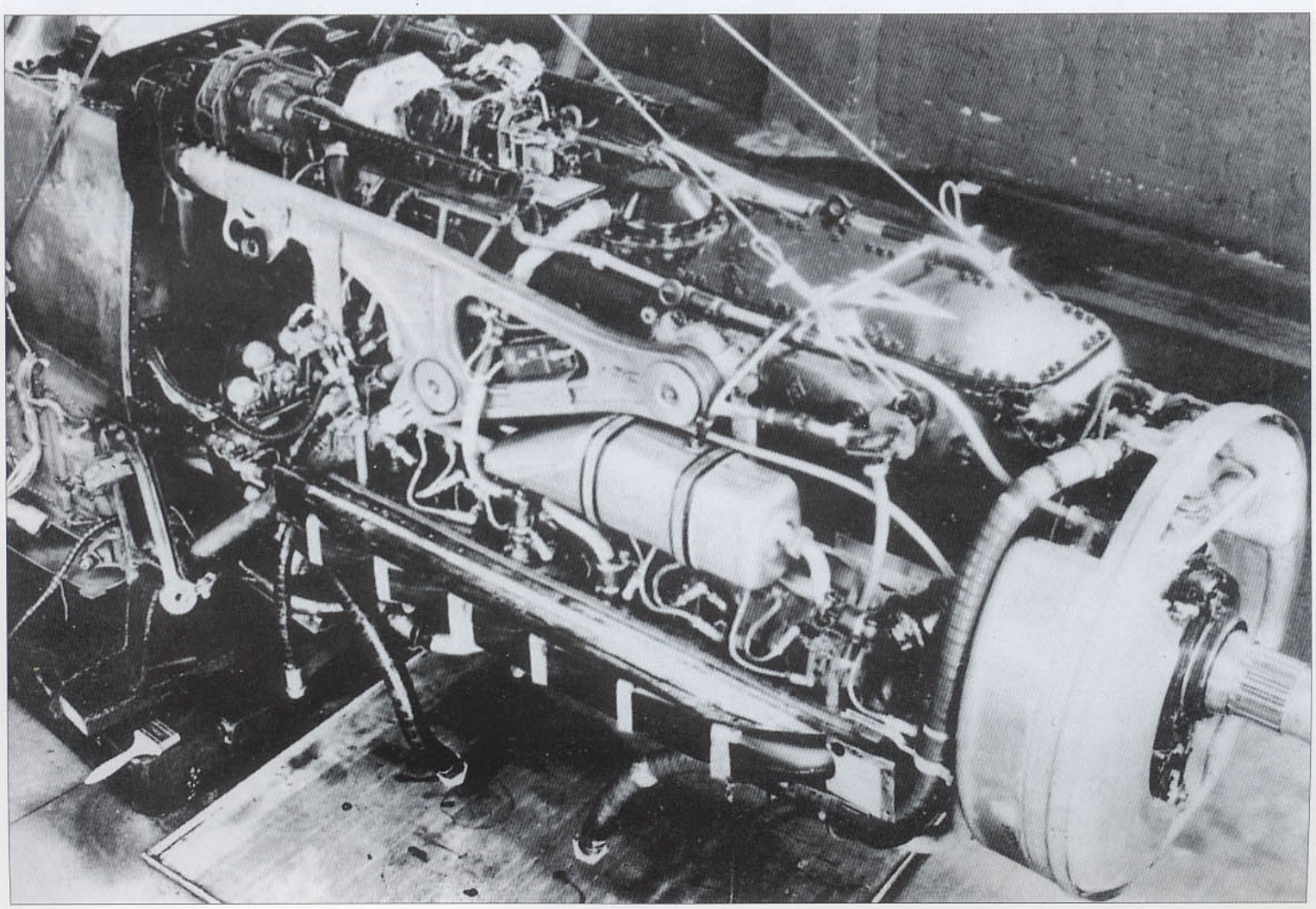
R1 – One ETC 500/IXb bomb rack mounted in the fuselage.
R2 – Four ETC 50/VIIId bomb racks planned but canceled.
R2 – Rb 50/30 reconn camera with MW 50 plus a 300 ltr drop tank.
R3 – Rb 75/30 camera, 2x300 ltr d/t, no armor, MG 131s or R6.
R3 – New application after above canceled. 1 x 300 ltr. drop tank.
R4 – Rb 50/30 as R2 but with 2 x 300 ltr. d/t. Canceled.
R4 – Two MK 108 cannon mounted underwing.
R6 – Two MG 151 cannon mounted underwing.
R7 – Direction finding equipment.

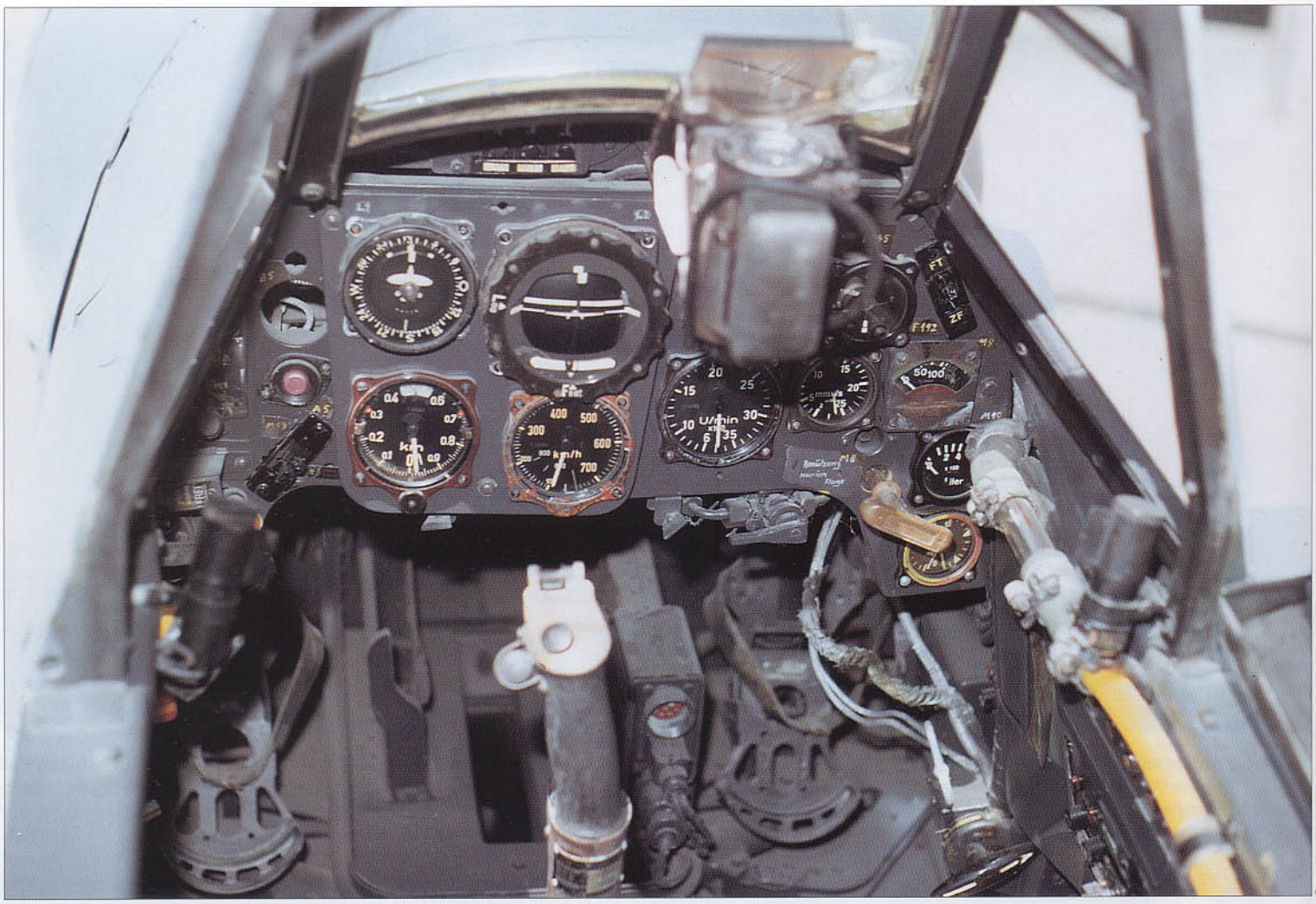
Above: Bf 109 G-6/R3, W.Nr. 160756, KT+LL, originally yellow 4, photographed on April 17, 1974, immediately after restoration by the National Air and Space Museum. This aircraft was captured on July 25, 1944, after its pilot, *Uffz.* Réné Darbois, of 3./JG 4, purposely landed at the American controlled airfield of Santa Maria L/G, near Rome, Italy. Because so little information of this aircraft survived, it was decided to paint the aircraft in a scheme common to other aircraft of the type and to allocate it the *Werk nummer* (serial number) 160163. It is worth noting that, given the large number of Bf 109 G-6s built, the odds against the NASM team guessing the correct serial number block, much less the numbers within this block, were quite high. Yet the team came incredibily close to the actual serial number which was 160756...off by only 593 aircraft. This aircraft had apparently been reconditioned while in German hands prior to its capture. For instance, the combination of a fixed loop homing antenna together with a tall radio mast was extremely rare. Inside the cockpit, the instrument panel is a replacement item from a Bf 109 G-4 (see p. 138). Additionally, the aircraft was probably originally fitted out as a so-called tropical version, complete with an external sand and dust filter at the supercharger intake (since the required operating handle was mounted in the cockpit).

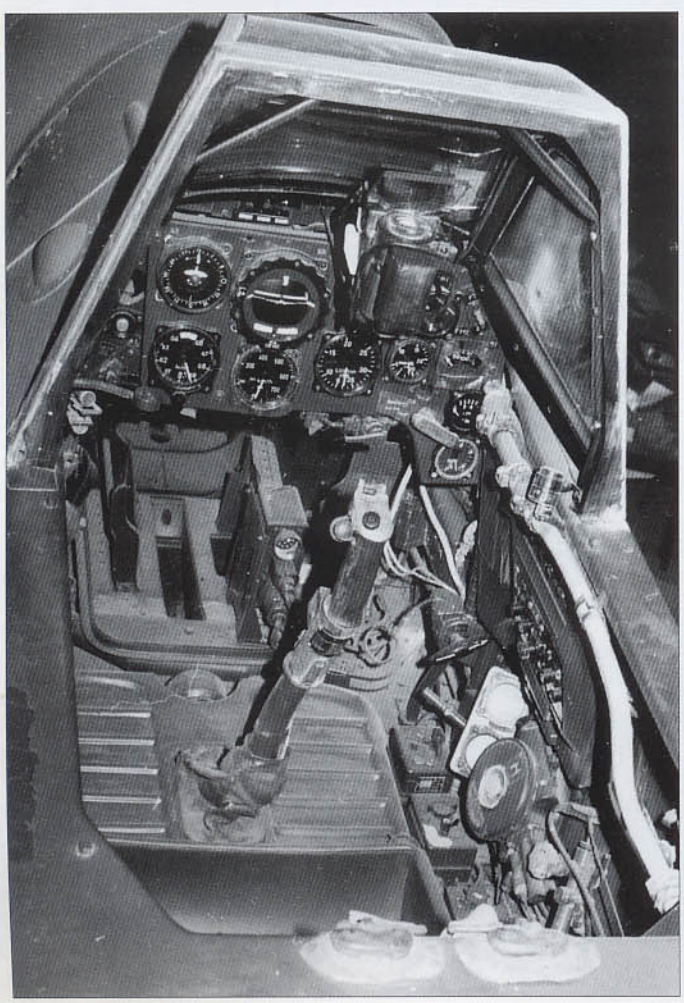


Above: The exposed port side to the DB 605 A-1/Tp, W.Nr. 01101016, fitted to the Bf 109 G-6 owned by the National Air and Space Museum. This photograph was taken during restoration and shows the engine compartment was compact and efficient.

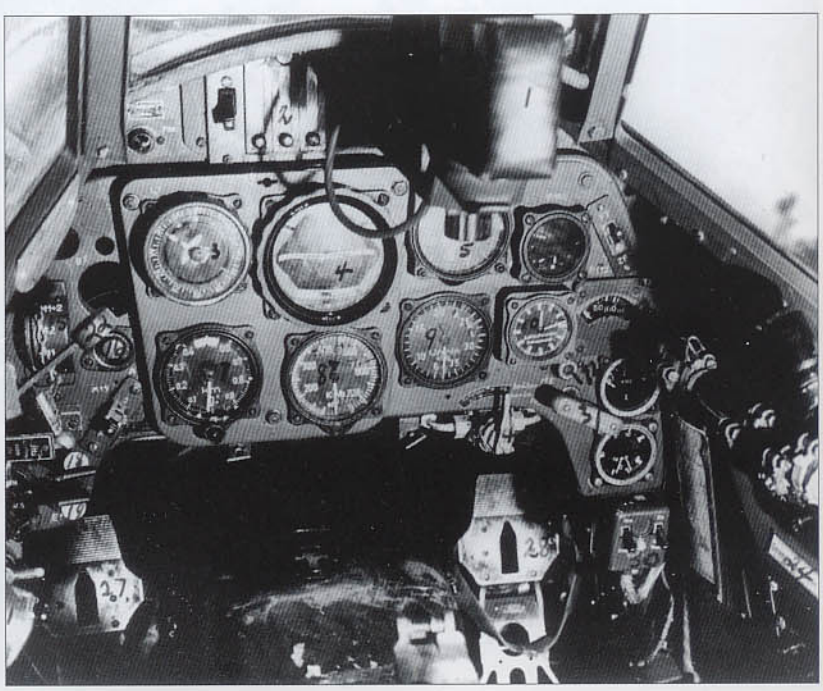
Below: A overall view of the DB 605 A-1 installed in a Bf 109 G-6/tp, W.Nr. 16416, white 9, captured by American forces in 1943 and subsequently shipped to the United States.



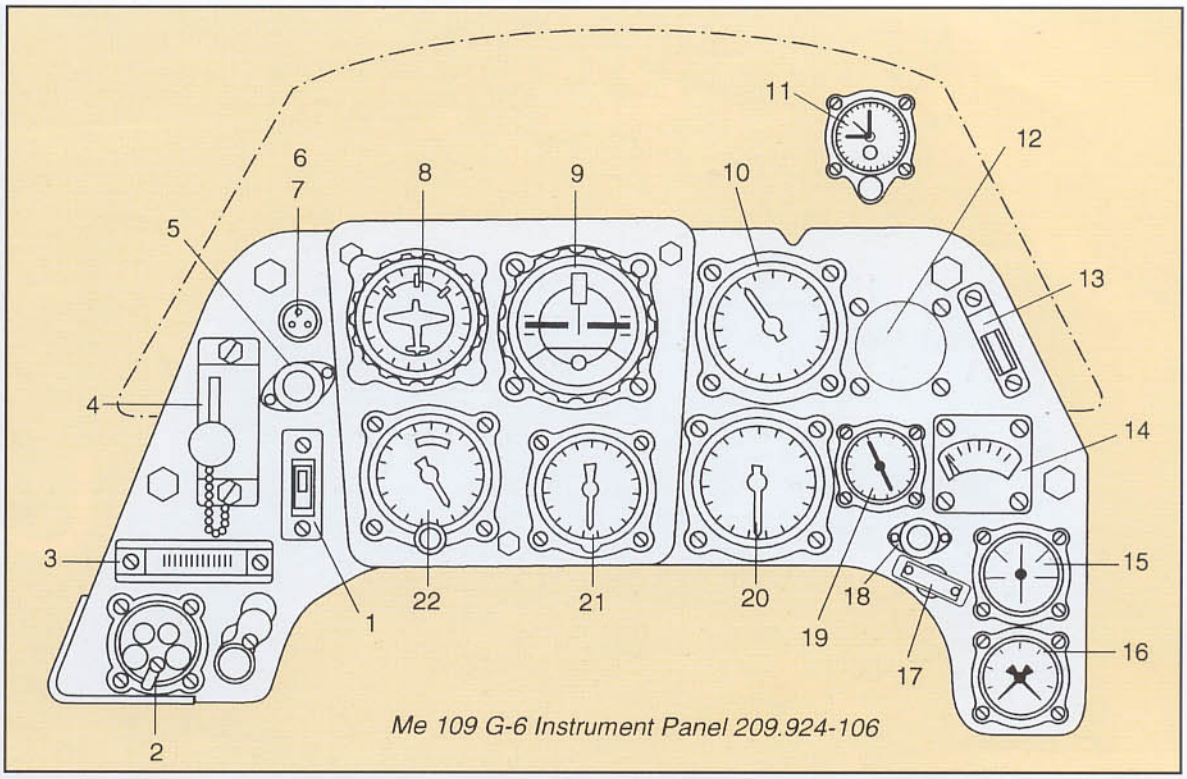




The photographs on this page illustrate the interior of the Bf 109 G-6/R6 owned by the National Air and Space Museum. The photograph below was taken in 1944 soon after it was captured, but prior to its transfer to the United States. It is interesting to note that at the time of capture, this aircraft had a panel from a Bf 109 G-2 or 4 (see p. 118) characterized by having round counters for the cowl-mounted MG 17s (empty hole next to Patin repeater compass). It is noteworthy that the cover for the MG 151/20 has disappeared and is no longer with the aircraft.

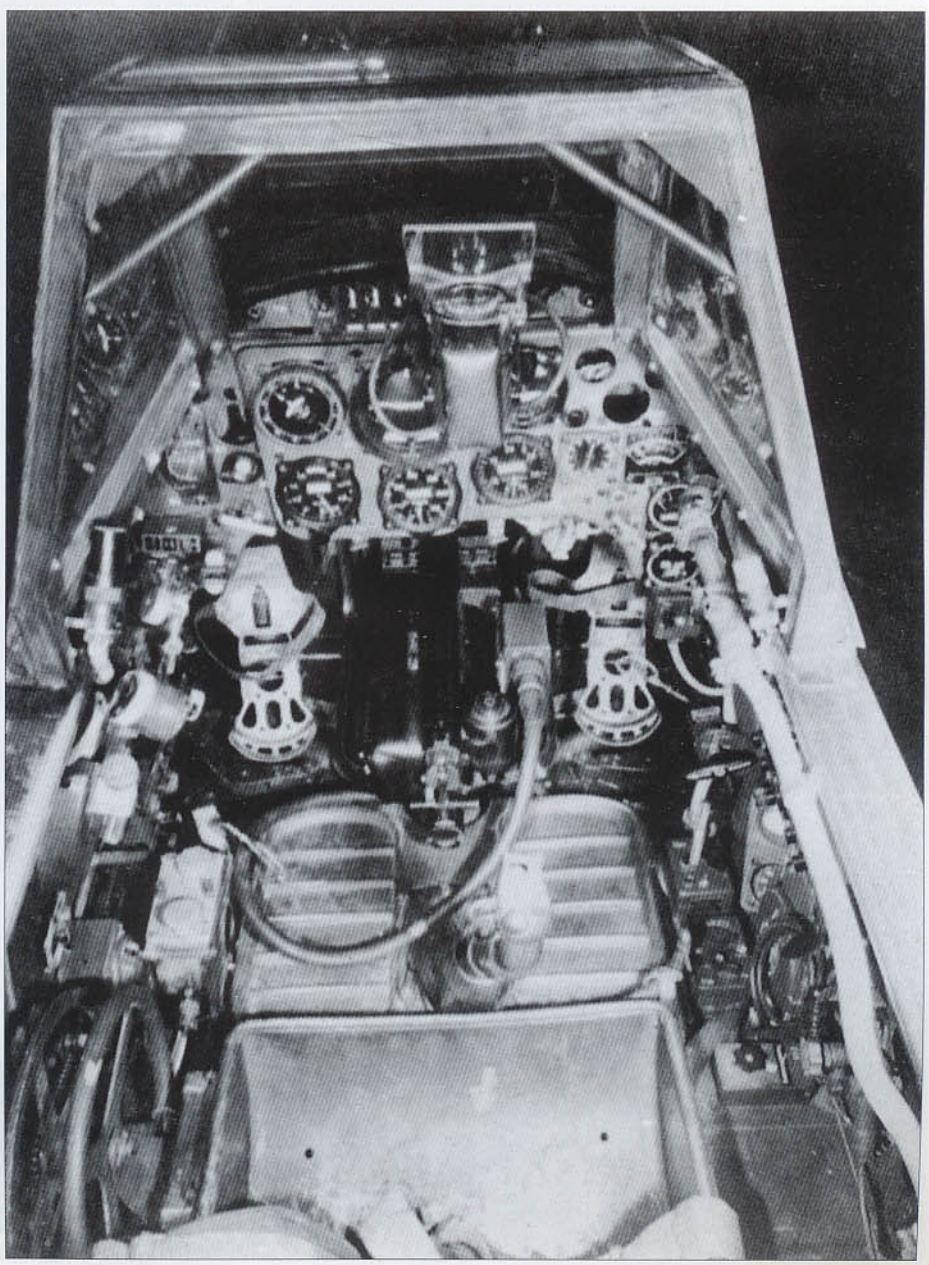


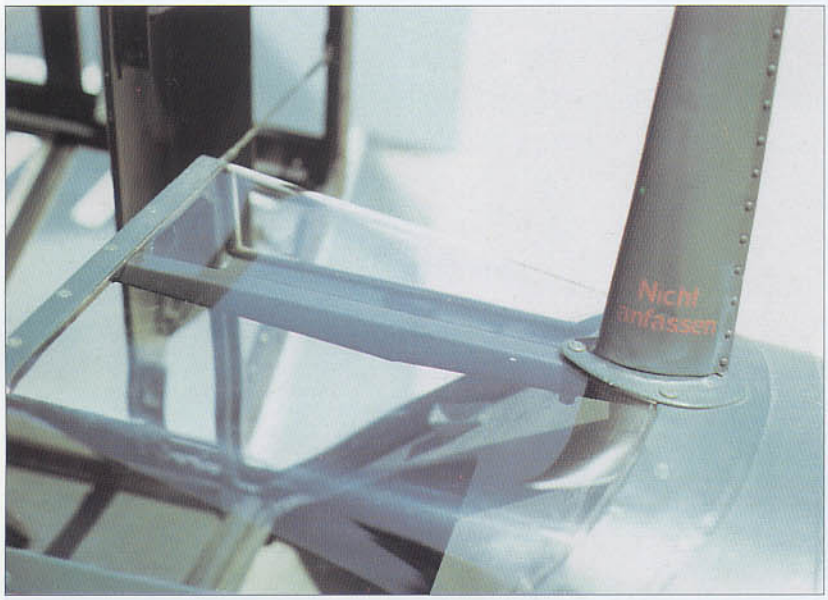
1. Start plug cleansing switch
2. Undercarriage position indicator
3. Starting panel
4. Ignition switch panel
5. Master switch
6. Signal light
7. Lamp
8. Repeater compass
9. Turn and bank indicator
10. Supercharger boost pressure gauge
11. Clock
12. AFN 2 homing indicator
13. Tumbler switch
14. Fuel + oil temperature gauge
15. Fuel contents indicator
16. Fuel + oil pressure indicator
17. Emergency handle for gear
18. Low fuel warning lamp
19. Variometer
20. Tachometer
21. Airspeed indicator
22. Fine and course altimeter

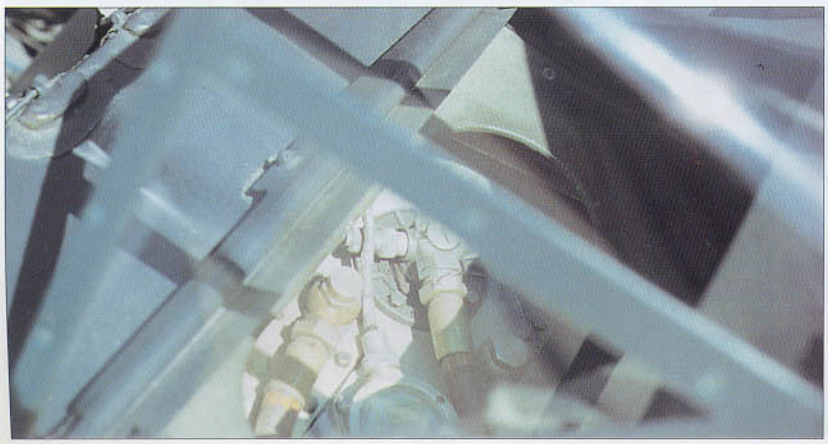


Me 109 G-6 Instrument Panel 209.924-106

Right: The cockpit of Bf 109 G-6/tp, W.Nr. 16416, shows a remarkable similarity to the one shown opposite, which begs the question of why these two aircraft carried panels associated with older production versions of the G-series. The illustration **above** depicts a panel design expressly intended for the G-6 series, which eliminated the MG 17 round counters (the G-6 was armed with MG 131s). Note that the large cover for the engine-mounted MG 151/20 cannon (shown between the rudder pedals) has been removed in this photograph.




Nicht
anfassen



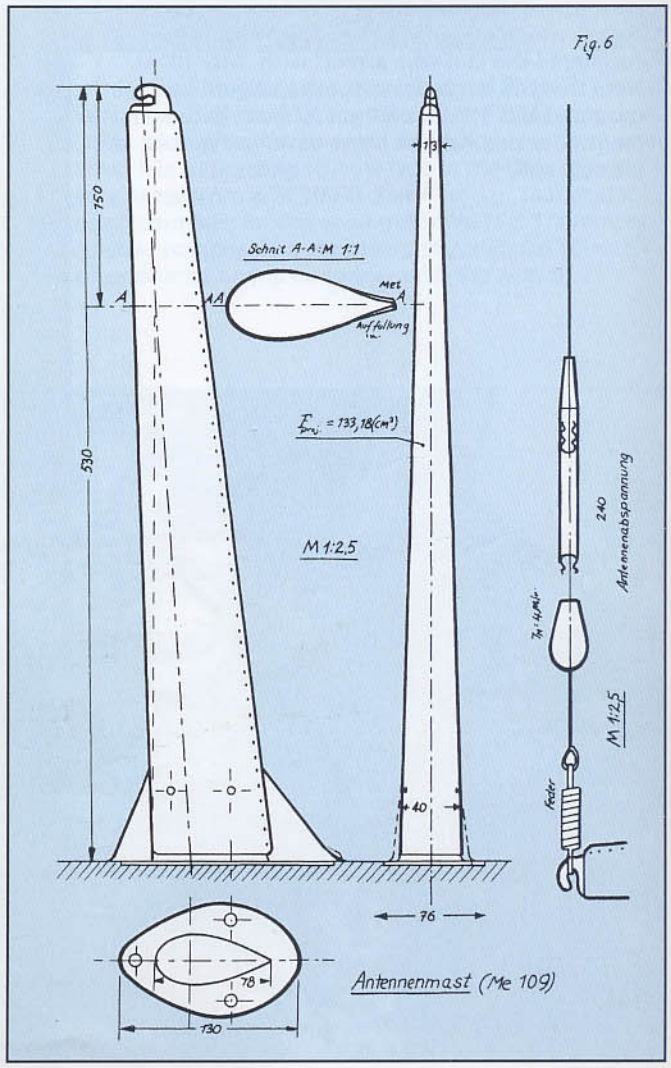
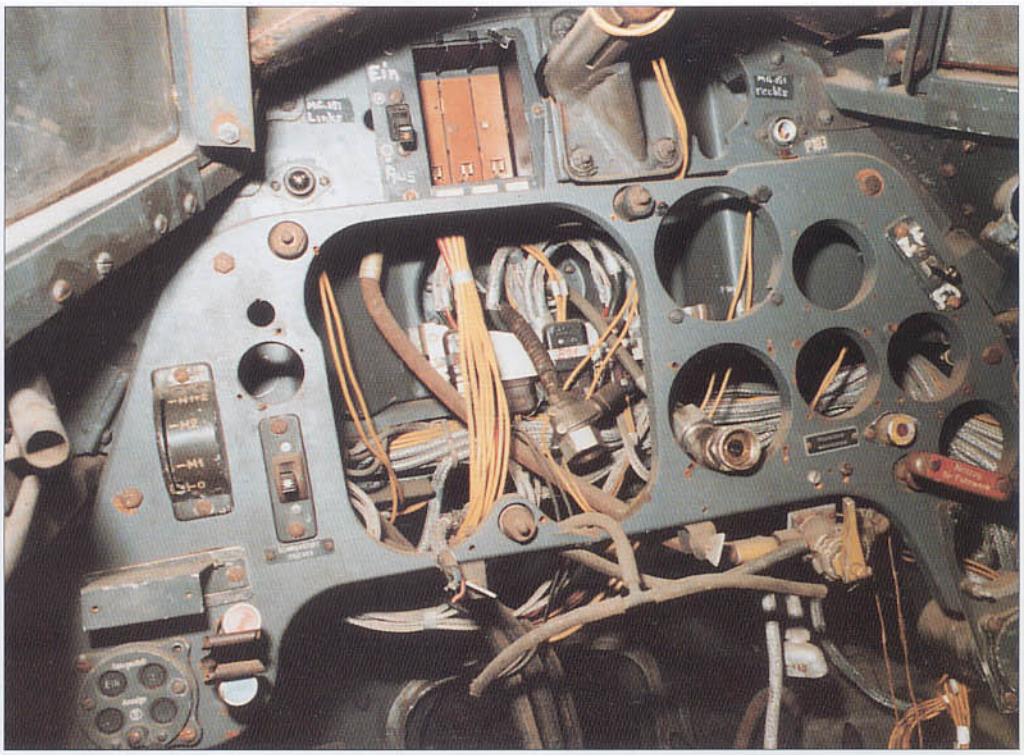
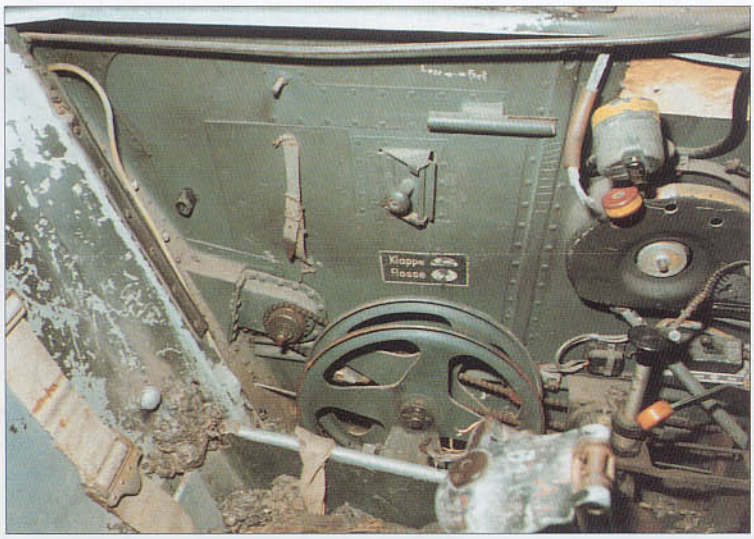


Fig. 6
150
530
Schnitt A-A: M 1:1
A
A
Auffaltung
M 1:2,5
13
40
76
78
730
240
Antennenabspannung
M 1:2,5
Feder
Antennenmast (Me 109)

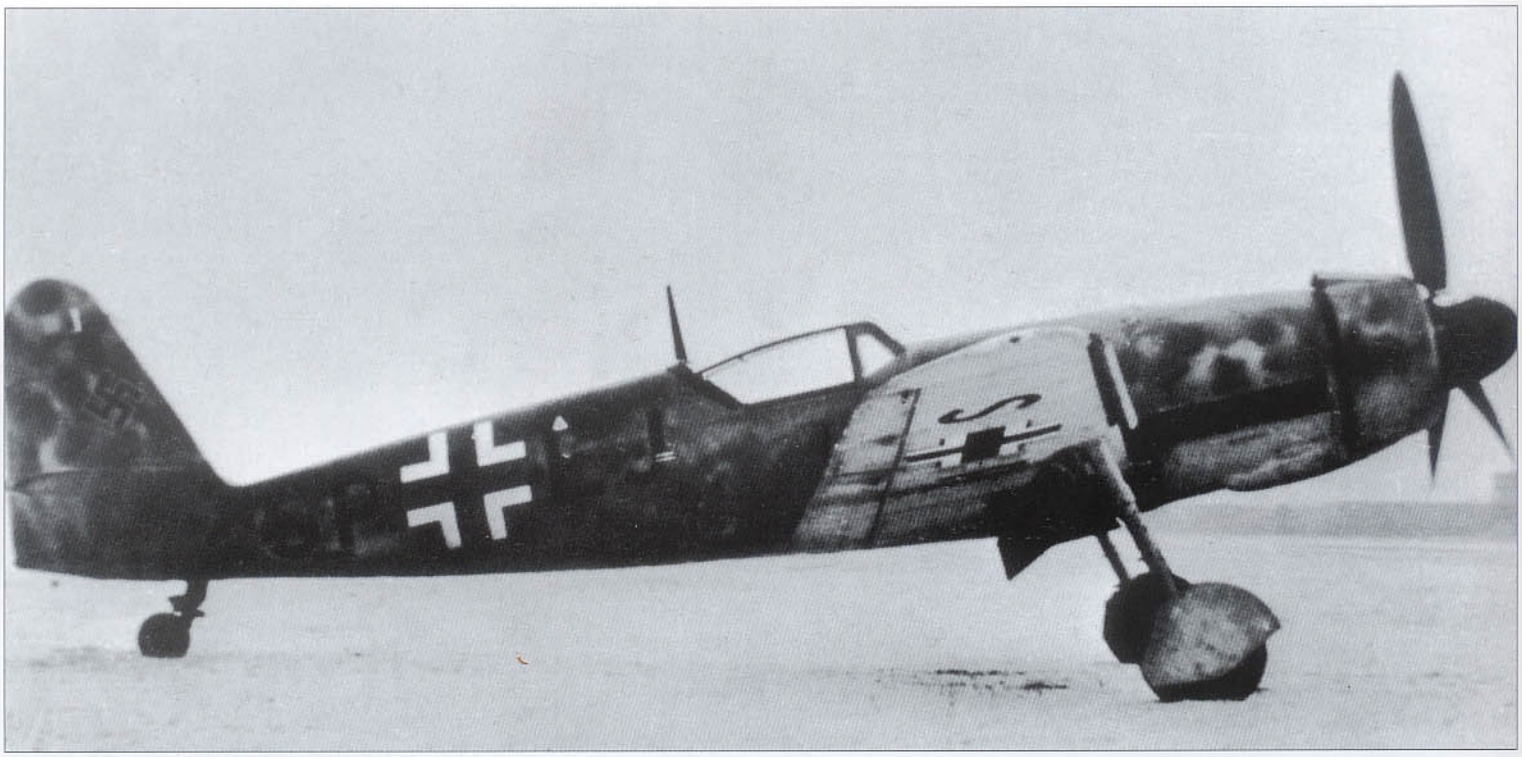
Right: The present condition of the unrestored instrument panel to Bf 109 G-6, W.Nr. 163824. This aircraft was brought to Australia in 1946 for inclusion in the Australian War Memorial (AWM), but due to a lack of available space, it was offered for sale and was purchased by the late Sidney Marshall who stored the aircraft in his firm's hanger at Bankstown, New South Wales. It has since been returned to the AWM awaiting professional restoration. In contrast to the Bf 109 G-6s shown on pages 138 and 139, the layout of the instrument panel for this G-6 appears to closely match the pattern established for this series.



Opposite left: Allied pilots, used to more spacious cockpits, found the German Messerschmitt's cockpit to be downright claustrophobic, made all the worse by closing the heavy 50 lb (23 kg) armored canopy.



Below: Although in rough condition, the interior of the Australian Bf 109 G-6 is original.



Messerschmitt Me 209 V5

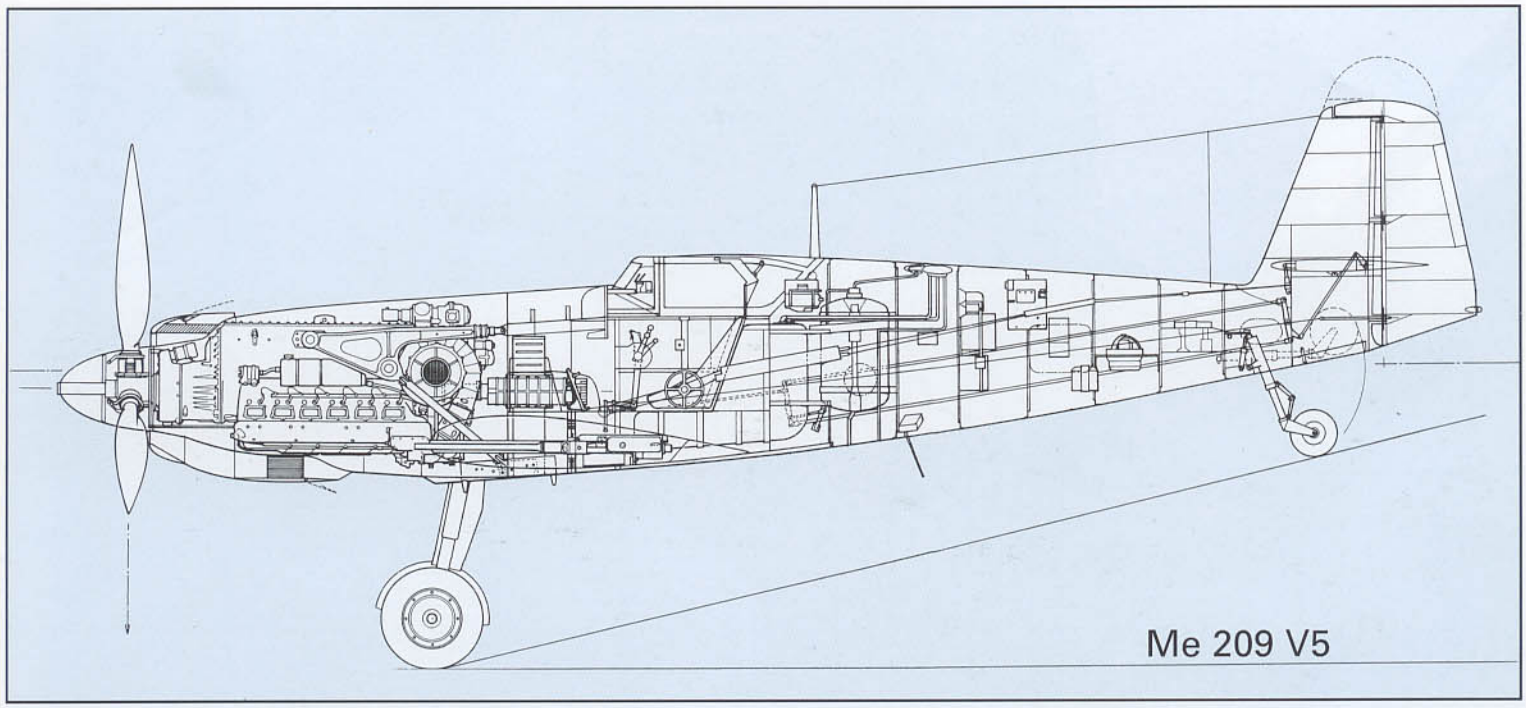
The Messerschmitt Me 209 V5 was officially the fifth prototype of the 209 family, but in reality it bore no resemblance to the first four prototypes (see p 70-75)of this series. Instead, it was created by Messerschmitt to fulfill a 1942 RLM requirement for a single-seat, medium-altitude, day escort fighter issued jointly to Messerschmitt and Focke-Wulf. Willy Messerschmitt reasoned that to meet the Air Ministry's requirement in the shortest possible time, the new fighter must be heavily based on his successful Bf 109 (i.e. the Bf 109 G-series then entering service). Messerschmitt's competitor for the contract, Focke-Wulf, headed by Kurt Tank, viewed their contender as a design strongly influenced by the firm's successful radial-powered Fw 190 A-series. Tank's design proposal, the Fw 190 Ra-4 (Ra - *Rechnerische Ankündigung* or Analytical prospectus) was based on either the Jumo 213A or DB 603A engines and, as presented to the Air Ministry it received the RLM/GL-C number 153 while Messerschmitt convinced the RLM to sanction his preference to use the GL/C number 209 for his new creation. No doubt this reflected Messerschmittís strong desire to see the number 209 associated with a new and successful development of the famous Bf 109.

Professor Kurt Tank and his staff began the task of modifying the standard Fw 190 airframe to take the more powerful Junkers Jumo 213A in-line engine with annular radiator in the first of a number of design studies based on the Fw 190 Ra-4 but now known as the Ta 153 Ra-1. Prof. Messerschmitt and his team set about to modify a standard Bf 109 G-5 (a pressurized fighter) by the installation of a larger and more powerful Daimler-Benz DB 603A engine, plus all-new tail surfaces. These were to be augmented by a completely new wing housing an inwardly-retracting undercarriage. In addition, the new Messerschmitt fighter was to incorporate an annular cooling radiator fitted snugly over the frontal area of the engine, thus dispensing with the under-wing radiators found on the Bf 109.

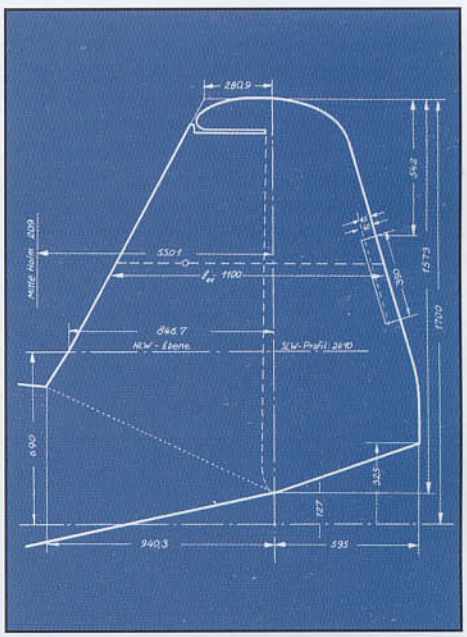
Armament planned for both the Focke-Wulf and Messerschmitt fighters was essentially the same. This consisted of an engine-mounted 30 mm cannon (MK 108), two cowl weapons (either MG 131s or MG 151s) plus two 20 mm MG 151/20s in the wing roots. Ultimately, the cowl weapons were dropped from consideration by both firms, due to weight and center of gravity considerations.

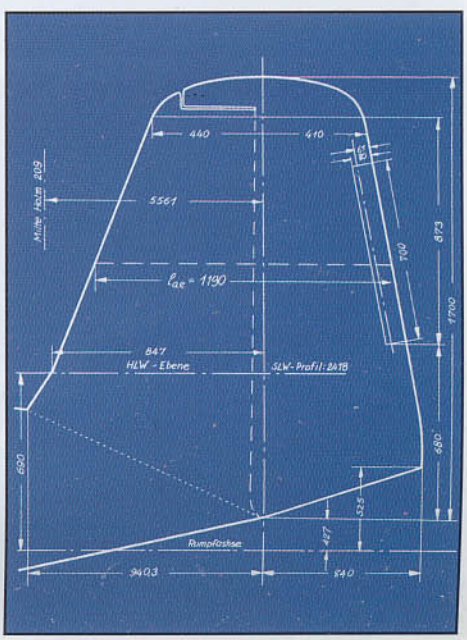
By the spring of 1943, both the Ta 153 and Me 209 were at the center of a political tug-of-war the outcome of which was yet to be decided. While prototypes for these two fighters were being assembled in their respective shops, Prof. Tank's team had taken the Fw 190 V32, W.Nr. 0057, GH+KV, which had been involved in the failed *Höhenjager* 2 program, and modified it by installing a DB 603G engine driving a four-bladed VDM propeller, extending the rear fuselage, and greatly increasing the area of the fin. In this new configuration, it was officially known as the Fw 190 V32/U1. Prof. Messerschmitt's team had modified a standard Bf 109 G-5, W.Nr. 16289, SP+LJ, to become the first of several prototypes planned for the new Me 209 A-series, the Me 209 V5. By autumn 1943, political machinations were such that both the Ta 153 and the Me 209 were all but canceled. Nevertheless, on November 3, 1943, Fritz Wendel successfully flew the Me 209 V5 for the first time, and in December 1943, the "short-cut" Ta 153 prototype, the Fw 190 V32/U1, was successfully flown. Initially, the Me 209 V5 was powered by a DB 603A driving a VDM three-bladed propeller, but it was later re-engined with the slightly more powerful DB 603G driving a Me P 8 three-bladed propeller. However, on January 13, 1944, the whole Ta 153/Me 209 program was finally canceled without ever having officially satisfied the *Begleitäger* requirement.

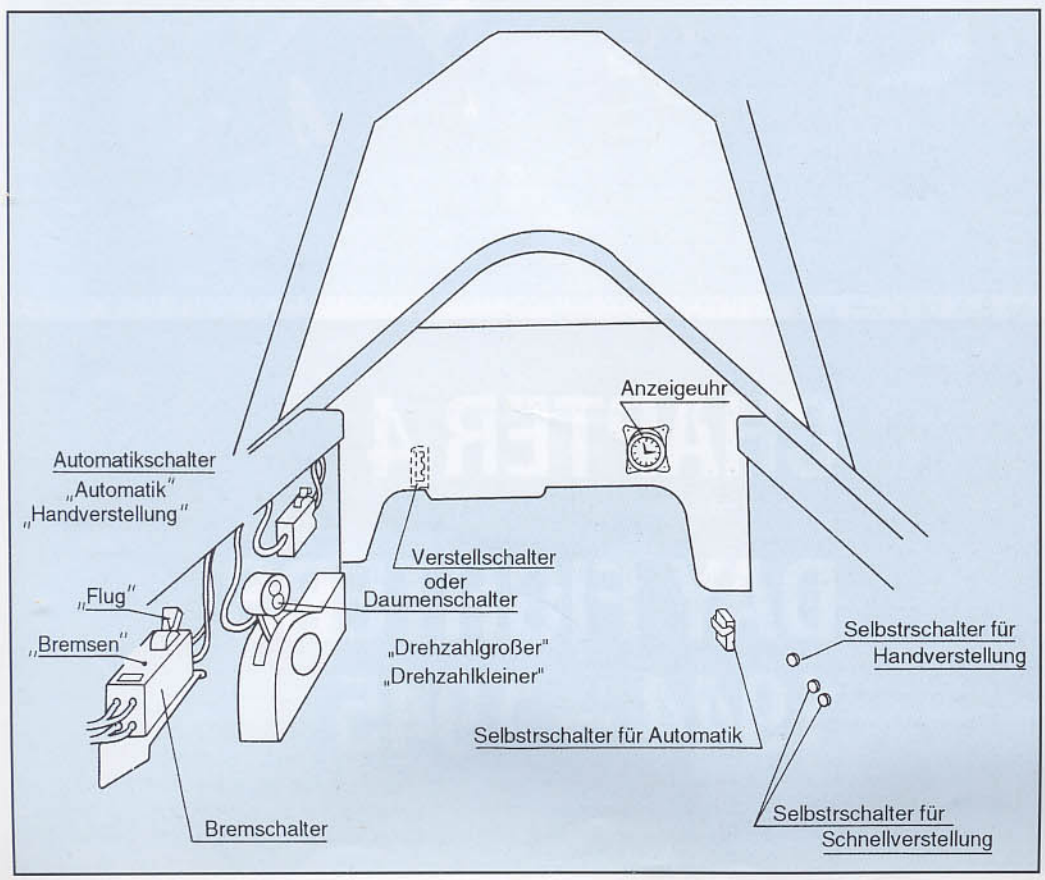
Above: This photograph of the Me 209 V5, W.Nr. 16289, SP+LJ, first published in the 1960s, is the only known image of this prototype to survive. Built as a contender for a 1942 Air Ministry requirement for a single-seat escort fighter, the aircraft was at the center of political controversy as to the wisdom of building jet verses propeller-driven fighters.



The second series of the Me 209, which resulted in the Me 209 V5, was originally to be equipped with exceptionally heavy armament including two machine guns above the cowl, one engine- mounted cannon plus two cannons in the wing roots. In addition to these, four more cannons were planned as auxiliary weapons. Two were to be mounted in underwing gondolas about mid span, and the other pair were to be enclosed in special bulged fairings beneath the wings and positioned to fire just outside the propeller arc. Provision was also made for the possible mounting of a PC 1000 bomb beneath the fuselage. However, by the time construction of the first prototype had begun, it was decided to initially restrict weapons to one engine-mounted cannon plus two 20 mm MG 151/20 cannons in each of the wing roots. Several vertical tailplane designs were investigated. Two are shown to the right, Vertical tailplane I and IIb. Tailplane design IIa, approved in August 1943, is shown mounted to the Me 209 V5 in the photograph shown opposite. The stylized illustration below, shows the requisite equipment for the Me P 8 propeller assembly.

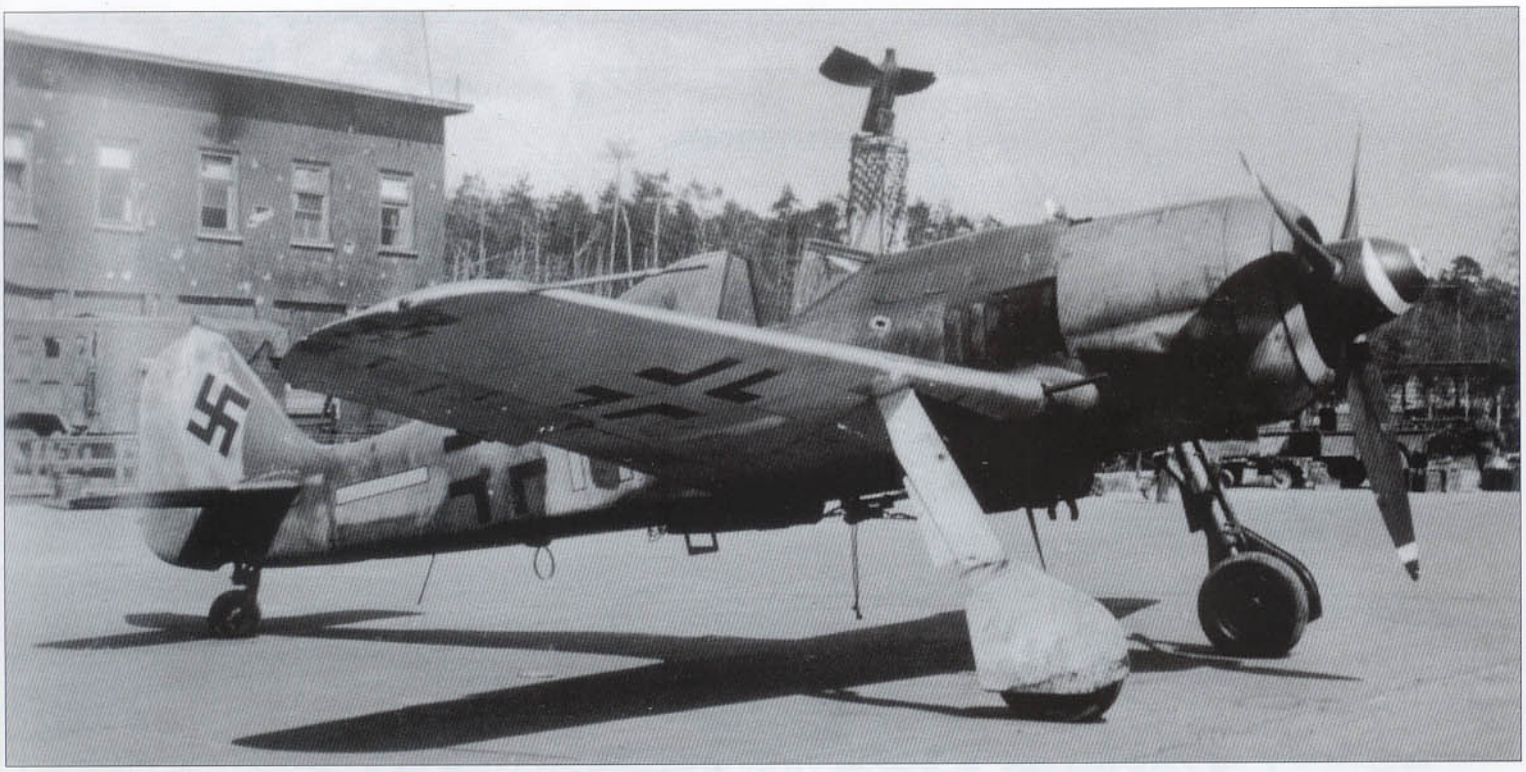






CHAPTER 4

DAY FIGHTERS 1944 – 1945



Focke-Wulf Fw 190 A-8

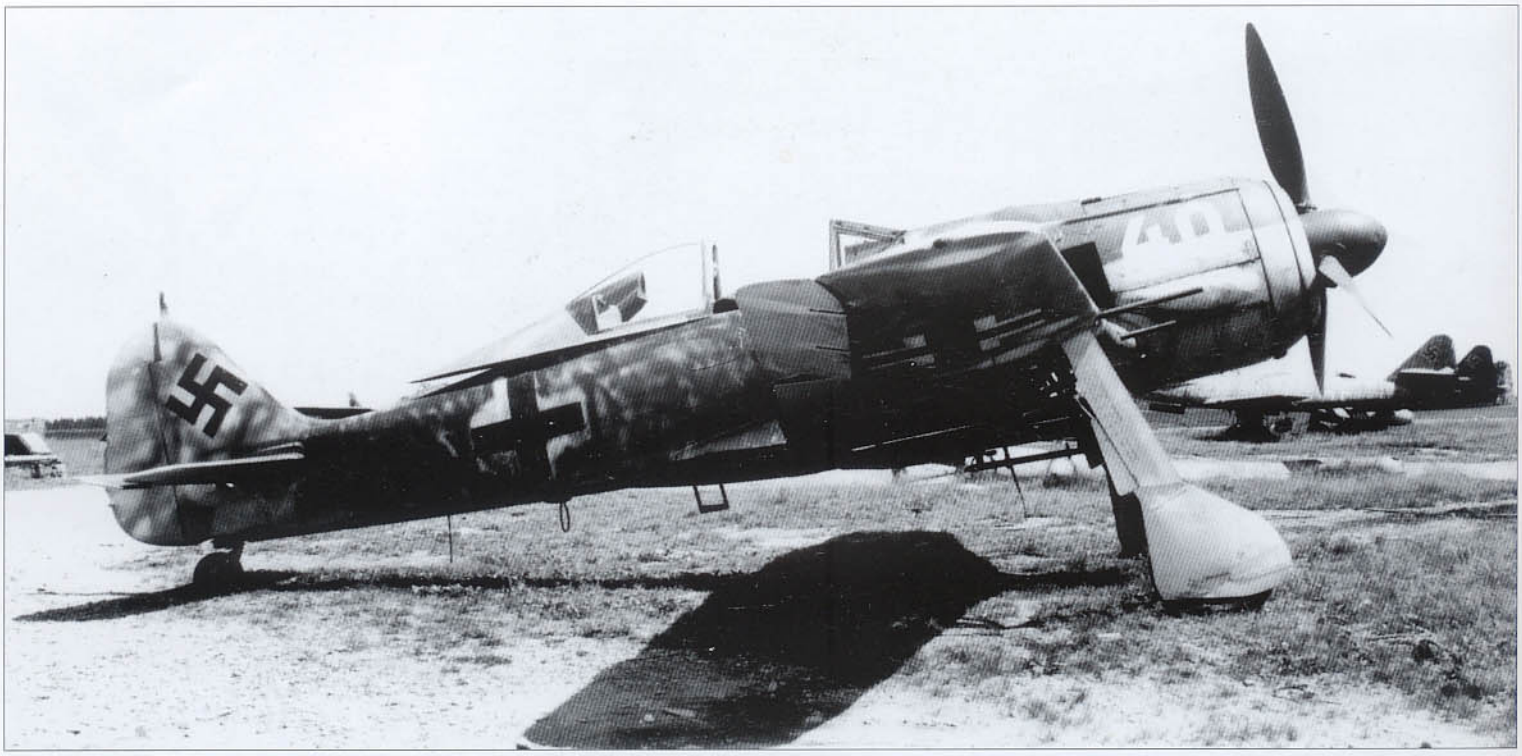
The seventeen months between January 1, 1944 and May 8, 1945, witnessed the arrival of an astonishing number of highly innovative German aircraft designs. Some of these were at the end of their development cycle while others were fresh creations just appearing for the first time. Almost all of these aircraft designs were created to meet a specific Air Ministry requirement, but as was so often the case within the Third Reich, these government requirements were subject to constant change. An aircraft designed initially as a fighter, a few months later might be subjected to revision for the bombing or reconnaissance role. In some cases, aircraft showing great promise were rushed into production before all engineering or performance problems had been fully resolved. In addition, German engineers were asked to seek new ways of conserving scarce materials such a aluminum. This often meant substituting wood for metal, or steel for aluminum. In addition, production quality control was slipping badly as more and more aircraft were being assembled by non-skilled workers laboring in less than ideal settings. Added to this is the fact that the German aero engine industry had great difficulty in introducing new internal combustion engines on a par with those of America or Britain. The jet engines that Germany was able to produce suffered from high fuel consumption and generally poor grade materials which resulted in short overhaul intervals thus reducing reliability.

The following fourteen aircraft types are presented, as in earlier chapters, in order of their appearance. The first type presented, the Fw 190 A-8, represented the zenith of the A-series. The next type, the Bf 109 G-14 was merely a progressive development of the earlier G-6. The Ta 154, made largely of wood, appeared too late to establish itself. The famous Me 262 was, for all its shortcomings, a truly outstanding achievement. The Fw 190 D-9 turned out to be a formidable warplane every bit as effective as the radial-powered A-series. The last series of the Bf 109, the K-series, appeared too late in the war to have made any difference. Fewer than sixty of the remarkable twin-engined Do 335 were completed, but this push-pull design offered great promise. The Bf 109 G-10 was the last production series to emerge, and like the similar K-series, its high performance came too late. Kurt Tank's wonderful creation, the Ta 152 H also appeared too late. But, in spite of the fact that it was broadly based on the older Fw 190, it was an exceptional flyer. No history of high altitude fighters would be complete without mention of the odd-looking BV 155. Although only one prototype was completed and flown before the war's end, it offered great promise. Undoubtedly, it was the highest flying propeller-driven fighter of the war, but it too appeared too late. Both the Ta 152 C and the Fw 190 D-13 were late arrivals which showed great promise in the role of medium altitude fighters. The final two fighters of this chapter, the He 162 and the all-wing Ho 229, were jet-powered, made largely of wood, and were relatively cheap and quick to build. These two fighters truly symbolized Germany by 1945. On the one hand the wooden Heinkel 162 was supposed to have stopped American heavy bombers while the sleek and revolutionary Horten 229 was to have pointed to the future.

The Fw 190 A-8 series was jointly produced from February 1944 by Focke-Wulf and Fieseler. In March 1944, NDW began deliveries, while the Ago firm commenced production during April 1944. More aircraft of this series were produced than any other for the Fw 190 with over 1,300 machines having been completed.

Opposite: A close-up of the windscreen and cockpit of the Me 262 A-1a held by the National Air and Space Museum.

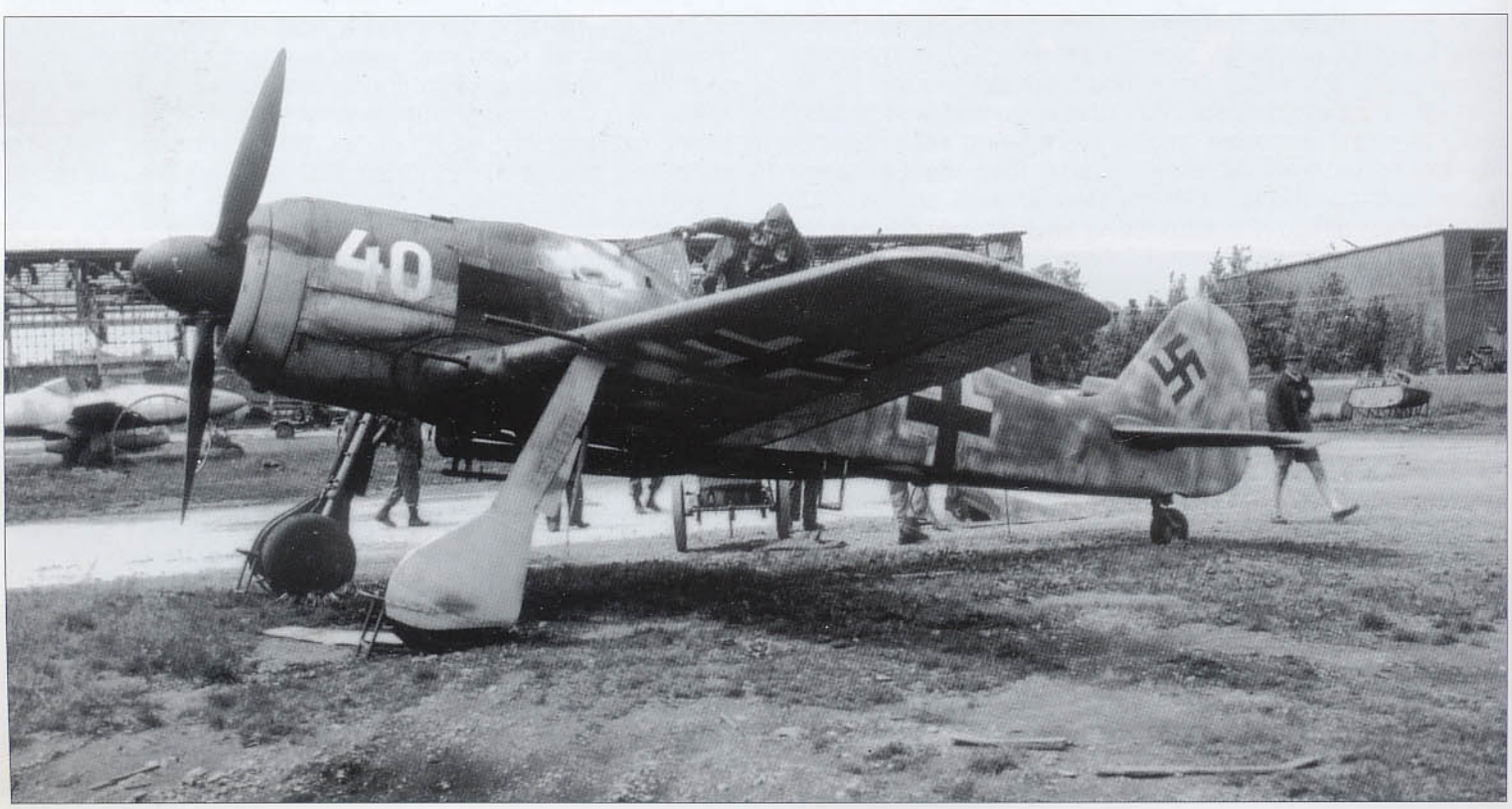
Above: This Focke-Wulf Fw 190 A-8, photographed at Rhein-Main airport on May 2, 1945, was attached to the 2nd *Gruppe* of an unknown unit. This particular aircraft is noteworthy because the outboard cannons have been inexplicably removed.

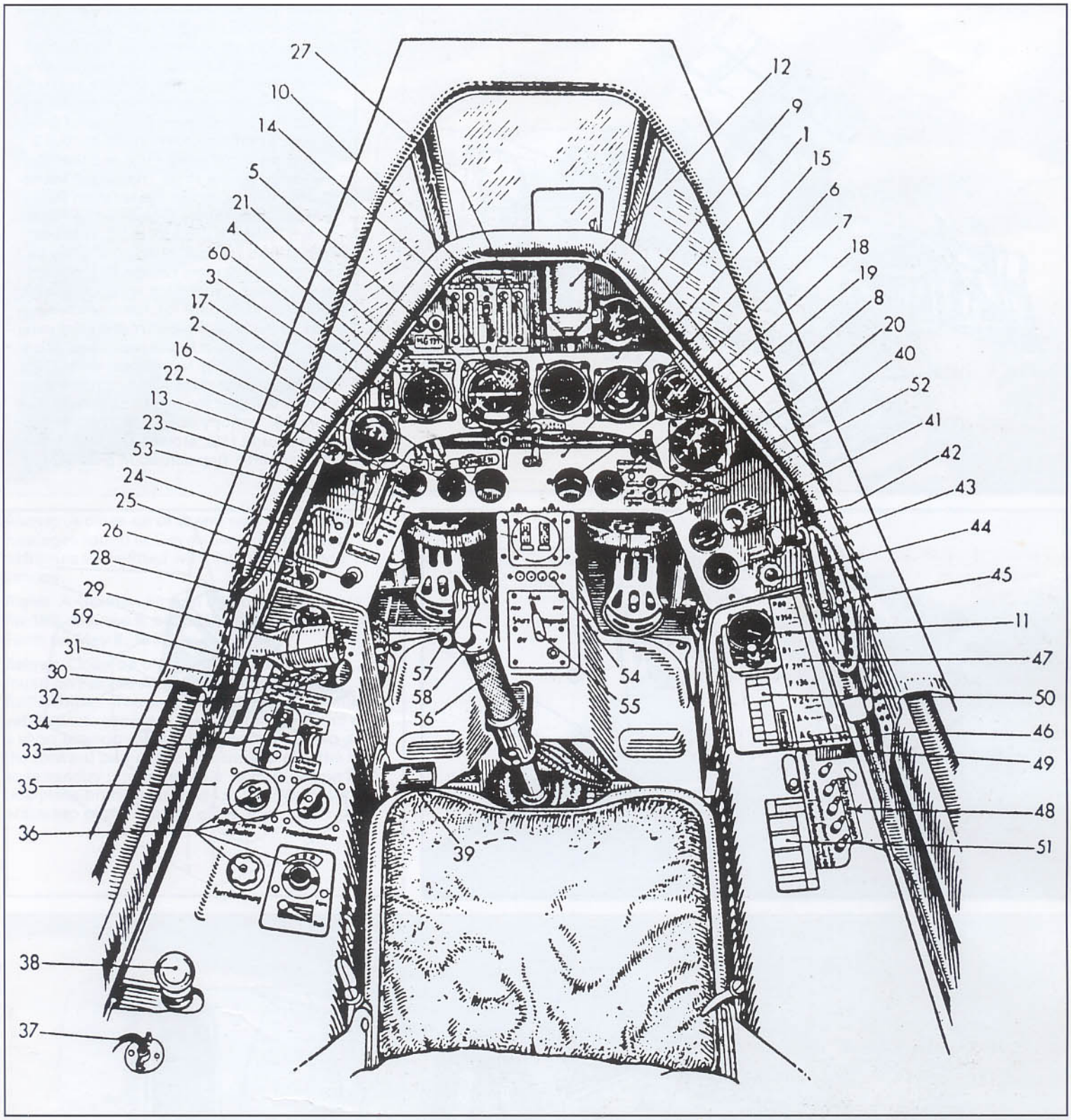


The Fw 190 A-8 was initially equipped with the BMW 801 D-2 driving a metal, three-bladed, VDM 9-12067 A propeller and armed with two 13 mm MG 131 machine guns mounted in the cowling, plus four 20 mm MG 151/20 cannon within the wings: two each in the wing roots and in the outer wing positions. Additionally, it had provision for one 78 gal (300 ltr) auxiliary fuel tank or one 1,102 lb (500 kg) bomb mounted beneath the fuselage. Electronic equipment consisted of the FuG 16Z-Y radio and the FuG 25a IFF.

Since the Fw 190 A-8 remained in production up to the end of the war in Europe, it was subjected to continual modification, in an attempt to increase performance of its engine, or to increase its versatility as a weapons carrier. For example, in July 1944, many new A-8s began to receive the BMW 801 TU engine (a hybrid 801 D-2 with parts from the TS/TH engine) with a VDM 9-12153 propeller. This engine was tested earlier on the Fw 190 V35, W.Nr. 816, BH+CF, which had previously been selected as a test bed for several different engines, including the BMW 801 F.

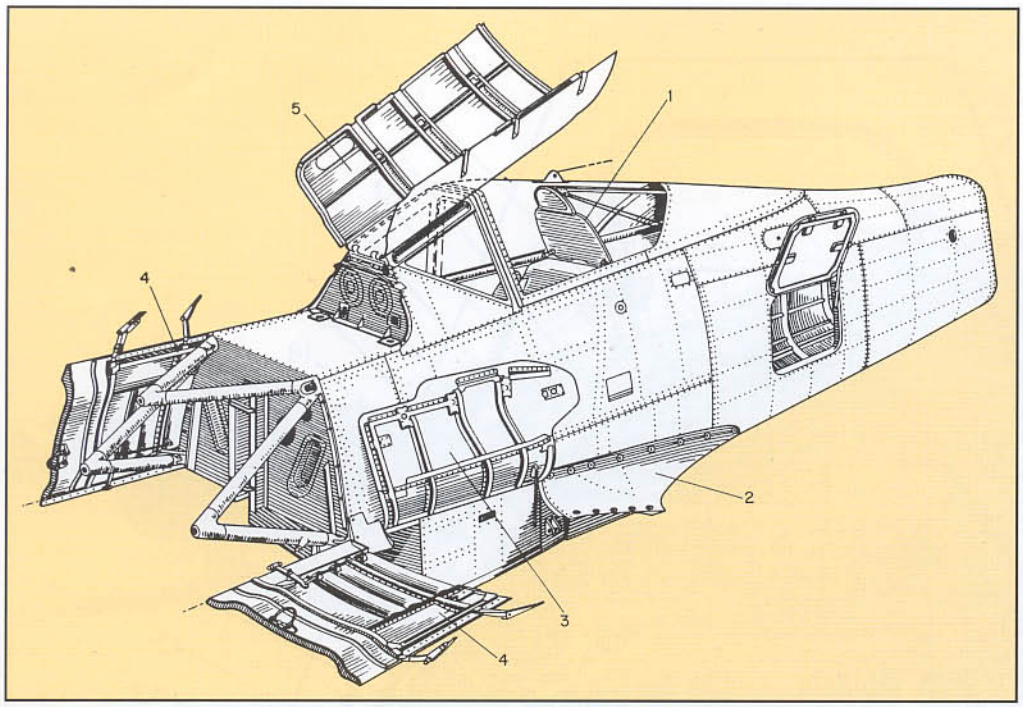
Above and below: Photographed in June 1945 at Messerschmitt's Lechfeld airfield, amid the remains of several incomplete Me 262s, was this clean Fw 190 A-8. Note the relatively high number painted to the cowl. This would usually indicate the aircraft was not attached to a front-line fighter unit. Entry was relatively easy and overall visibility from the cockpit was quite good.



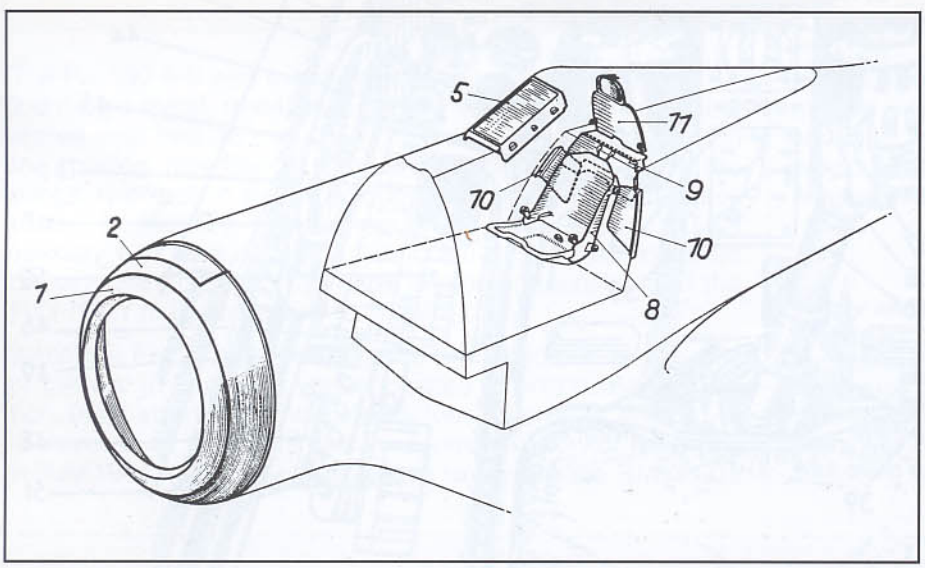


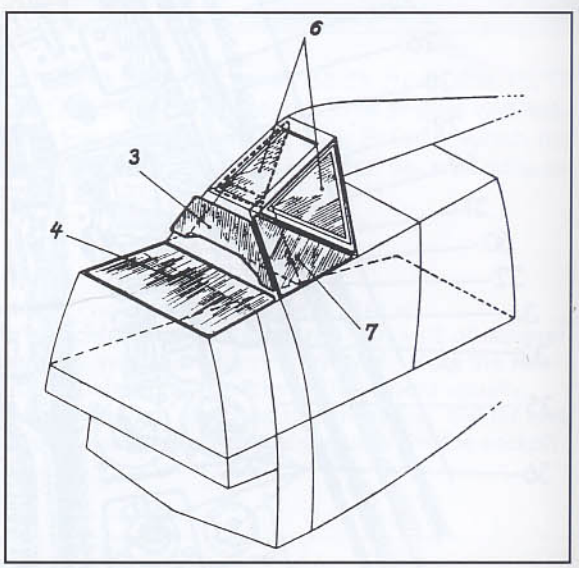
Focke-Wulf Fw 190 A-8

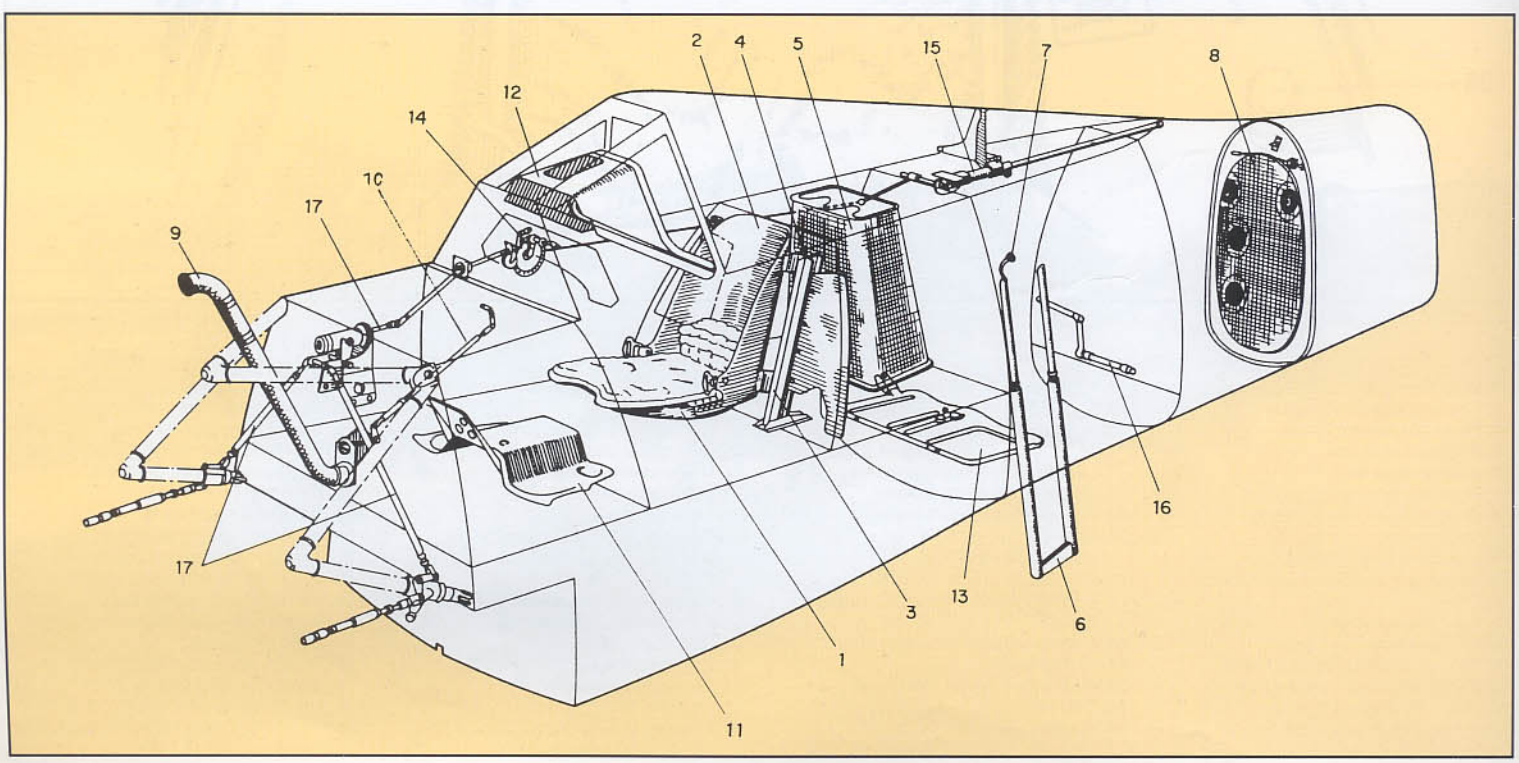
1. Main instrument panel
2. Fine and coarse altimeter
3. Pitot tube heater light
4. Airspeed indicator
5. Artifical horizon
6. Repeater compass
7. Supercharger pressure gauge
8. Tachometer
9. AFN 2 homing indicator
10. Armament switch, round counter
11. Clock
12. Revi 16 B gunsight
13. Cockpit ventilation knob
14. Engine vent flap position lever
15. Secondary instrument panel
16. Fuel + oil pressure gauge
17. Oil temperature gauge
18. Fuel contents gauge
19. Mechanical prop pitch indicator
20. Fuel low level warning level (top), Rear fuel tank switch over light (lower)
21. Windscreen washer lever
22. Fuel tank selector handle
23. Emergency undercarriage lowering handle
24. FuG 25a IFF control box
25. Engine starter brushes retraction button
26. Engine stop cock control lever
27. Variometer
28. Instrument panel lighting rheostat
29. Throttle
30. Ignition switch
31. Undercarriage and flap position indicators
32. Horizontal stabilizer trim indicator
33. Horizontal stabilizer trim switch
34. Undercarriage and flap extension switch
35. Left console
36. Volume, tuning, frequency and homing controls for FuG 16 ZY radio
37. Headset cord attachment point
38. Fuel primer pump handle
39. Throttle friction knob
40. Fuel gauge selector switch
41. Signal flare pistol holder
42. Oxygen flow indicator
43. Oxygen pressure gauge
44. Oxygen flow valve
45. Canopy position crank
46. Signal flare storage box
47. Circuit breaker panel cover
48. Fuel pump circuit breakers
49. Starter switch
50. Service data placard
51. Deviation data placard
52. Actuator for cockpit ventilation
53. 21 cm air-to-air rocket control (R6)
54. Bomb load indicator lights
55. Bomb fusing selector unit
56. Control column
57. Bomb release button
58. Wing cannon firing button
59. Prop pitch control on throttle
60. Instrument panel light (both sides)

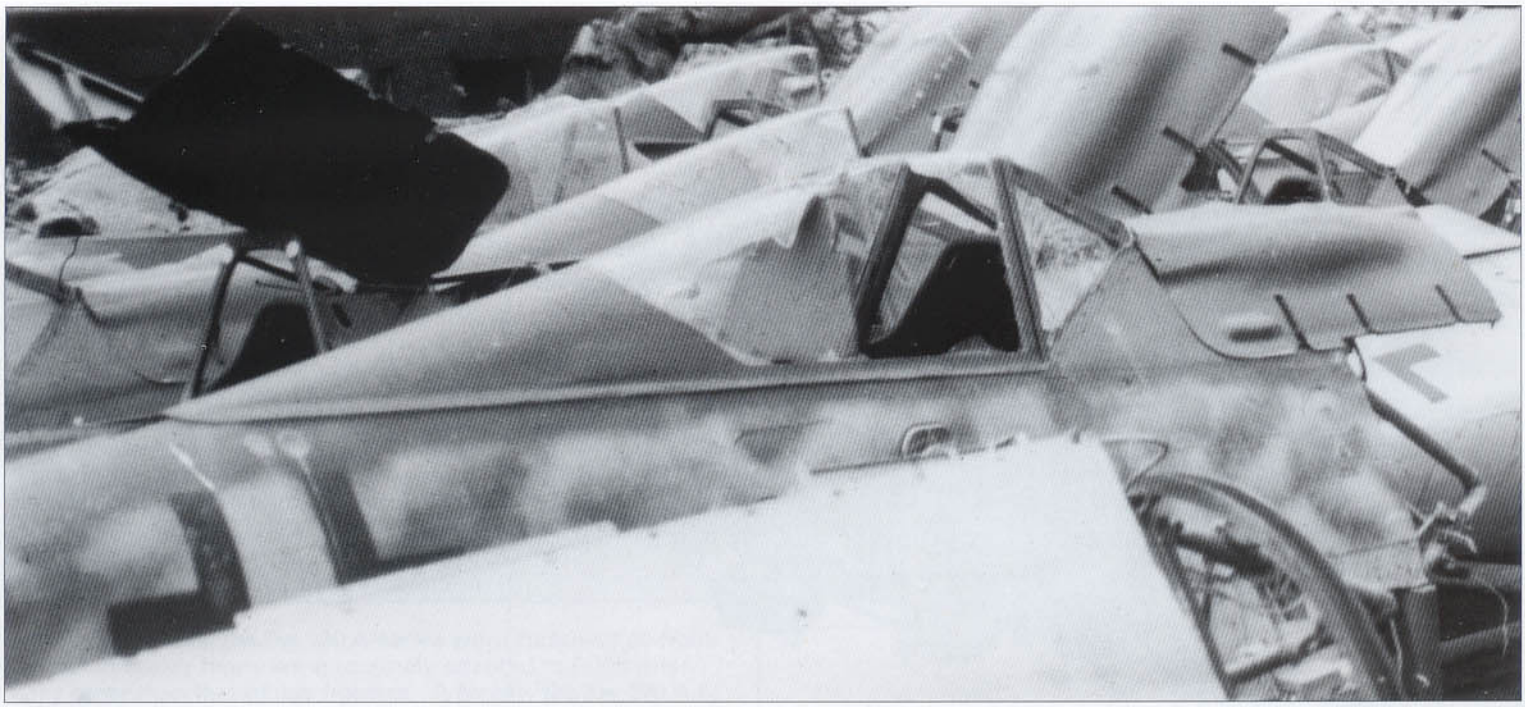


These four illustrations describe the main features of the Fw 190 A-8 fuselage. The **middle left** view shows the location of the armored (6.5 mm) cowl ring covering the cooling fan (1), the oil tank armor (5.5 mm) (2), the 50 mm armored windscreen (5), the armored seat back plate of 8 mm (8), the 5mm shoulder armor (9), the 5 mm back armor plate (10), and the 12 mm head armor (11). The sketch **immediately below** shows the location for additional armor as found on the Fw 190 A- 8/R7 and R8. The illustration at **bottom** shows the seat cushion (1), the armored back plate (2), the seat guides (3), the seat adjustment lever (4), the baggage compartment (5), the retractable foot ladder (6), the external ladder extension button (7), a fabric panel seal (8), a fresh air duct (9), ventilation lever (10), fuel tank cover plate (11), instrument panel (12), rear fuselage equipment support (13), canopy drive unit (14), canopy jettison unit (15), stowed starter crank (16), cooling flap actuation gear (17).





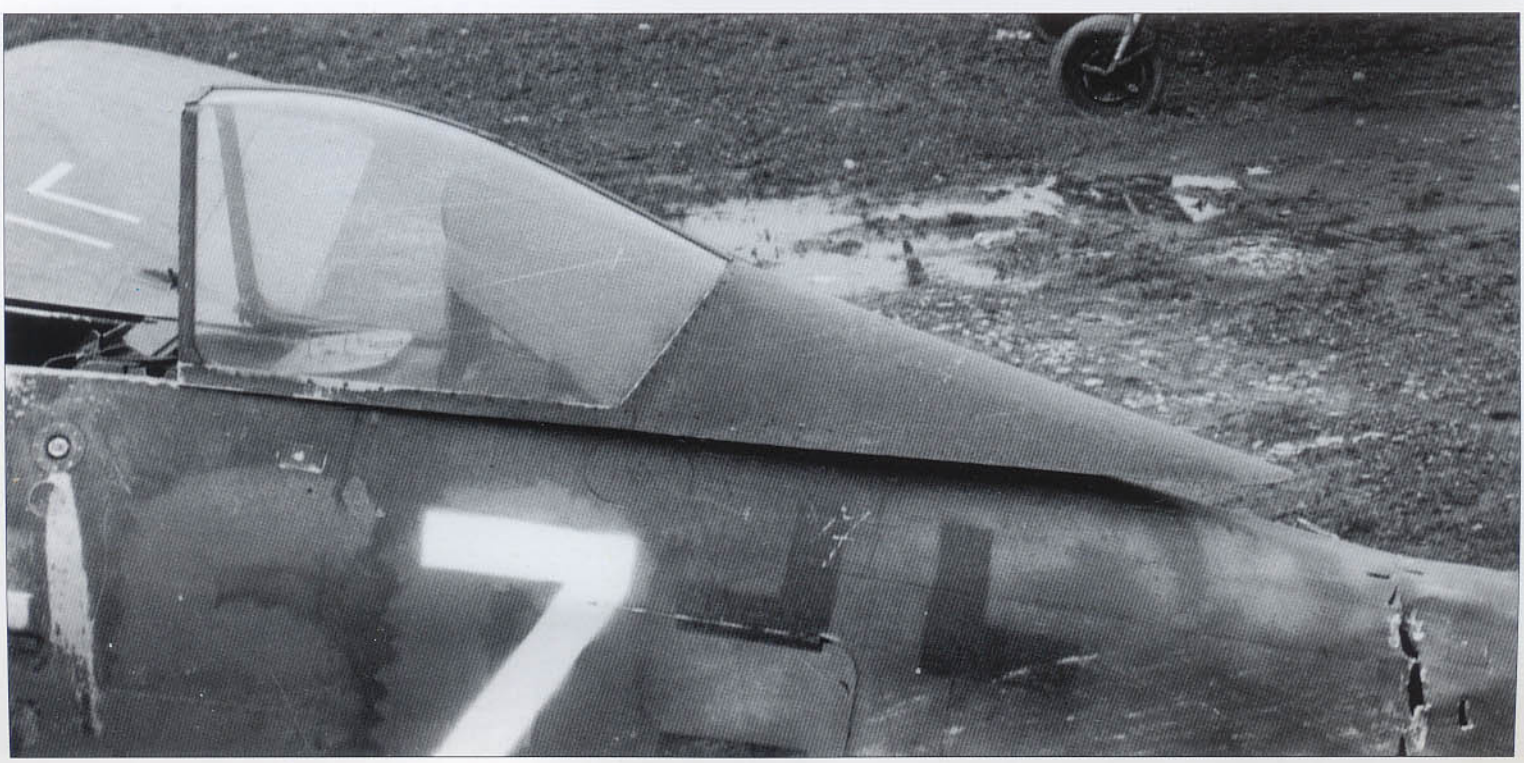


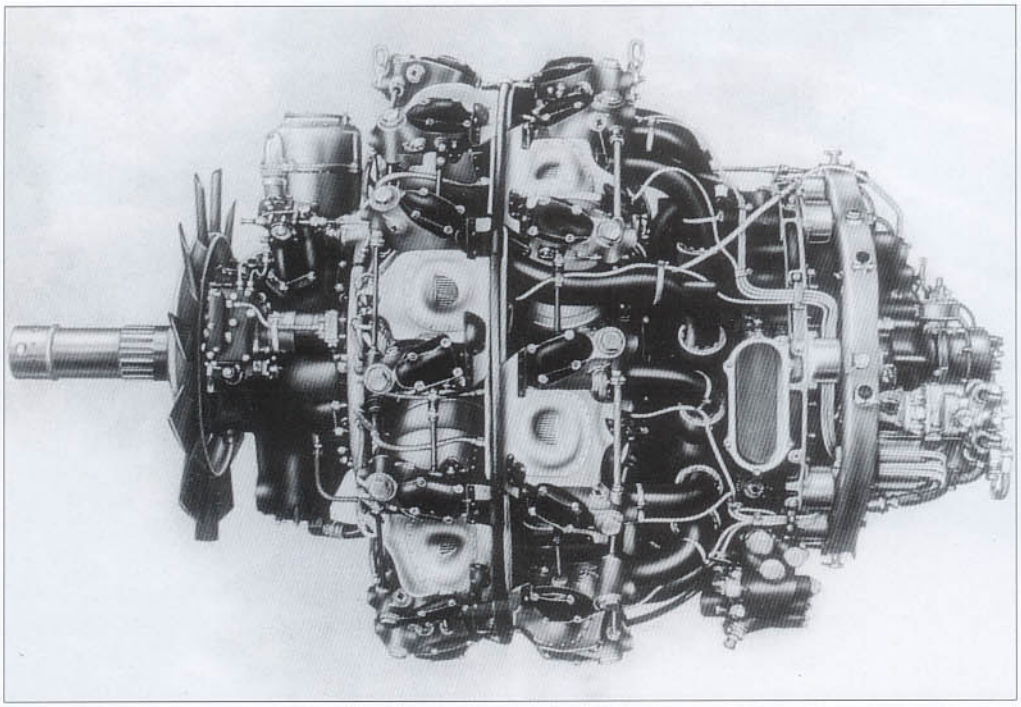


Above: A close-up of brand new Fw 190 A-8 fuselages found at Gevelsberg. Note these airframes were fitted with the original style canopy.

Right: A German airman climbing out of this Fw 190 A-8, red 5, of 1./JG 6, after landing at Fürth on May 8, 1945, to surrender.

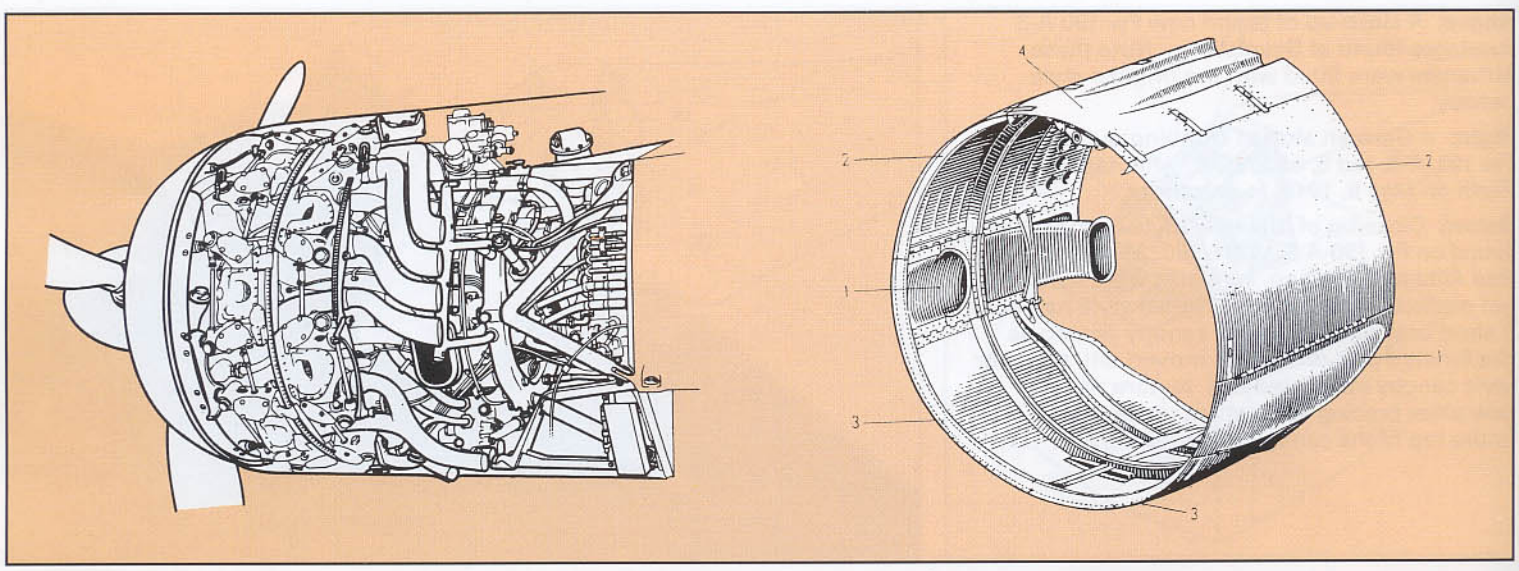
Below: Close-up of the later style canopy found on Fw 190 A-8, W.Nr. 960233, white 7, at Bad Ailbling. The two canopies were similar yet distinct. Whereas the original style had only a short bracing section (for canopy flexing as the forward part of the unit moved aft), the later style canopy integrated this feature within a one-piece bracing strip which ran down the entire top of the canopy glass.

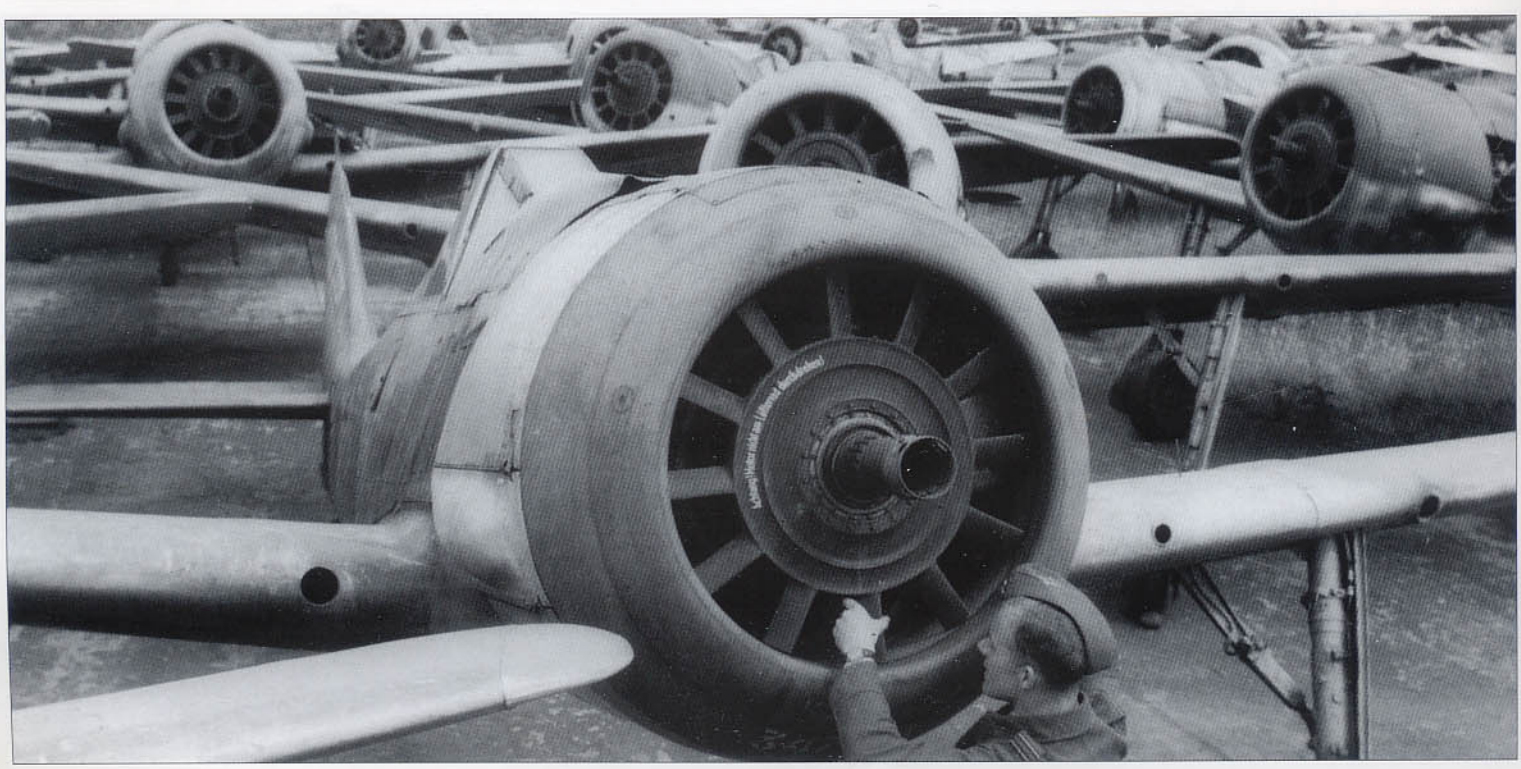


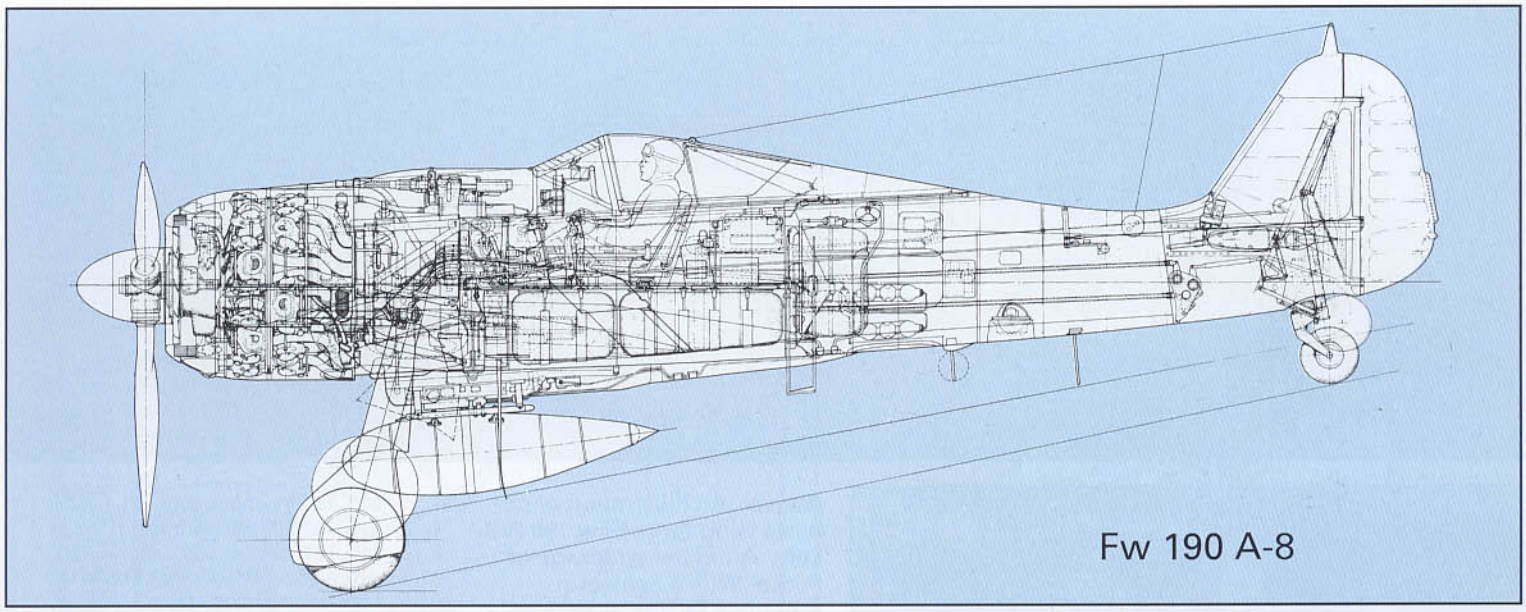


Left: Up to July 1944, the standard powerplant for the Fw 190 A-8 was the BMW 801 D-2. This 41.8 litre (2,560 cu in) fourteen cylinder double-row radial air cooled engine, using C3 fuel of at least 96 octane, developed 1,700 hp at 2,700 rpm. for take off. It was generally similar to the A- series except for its fuel requirement.

Bottom: This view of captured Fw 190s at Flensburg airfield without their propellers, spinners and weapons, graphically depict the 12-bladed engine cooling fans. The inscription of the fan of the aircraft in the center, Fw 190 A-8, W.Nr. 347173, reads: *Achtung! Motor nicht am Lufterad durch drehen!* (Attention! Engine not on fan wheel crank!). In July 1944, it was planned to fit all Fw 190 A-8s with the BMW 801 TU engine. This hybrid engine was very similar to, and interchangeable with, the D-2 series.

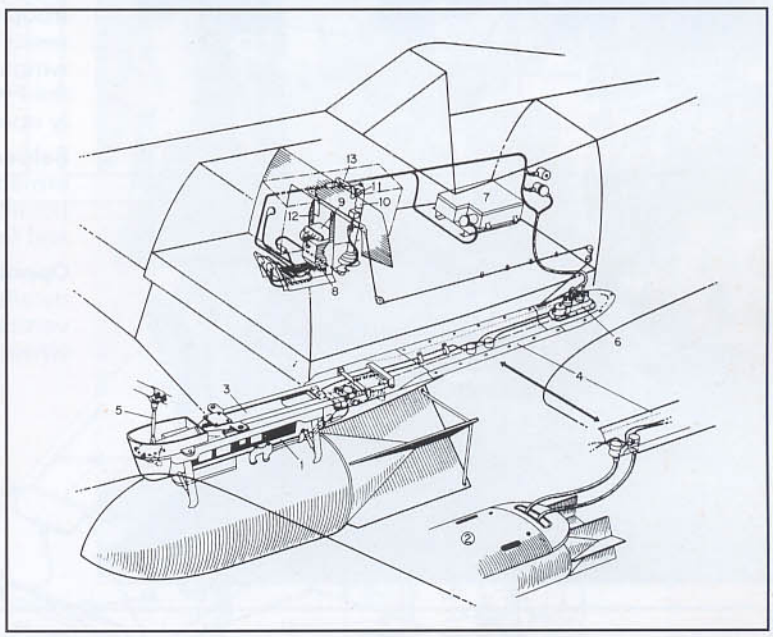


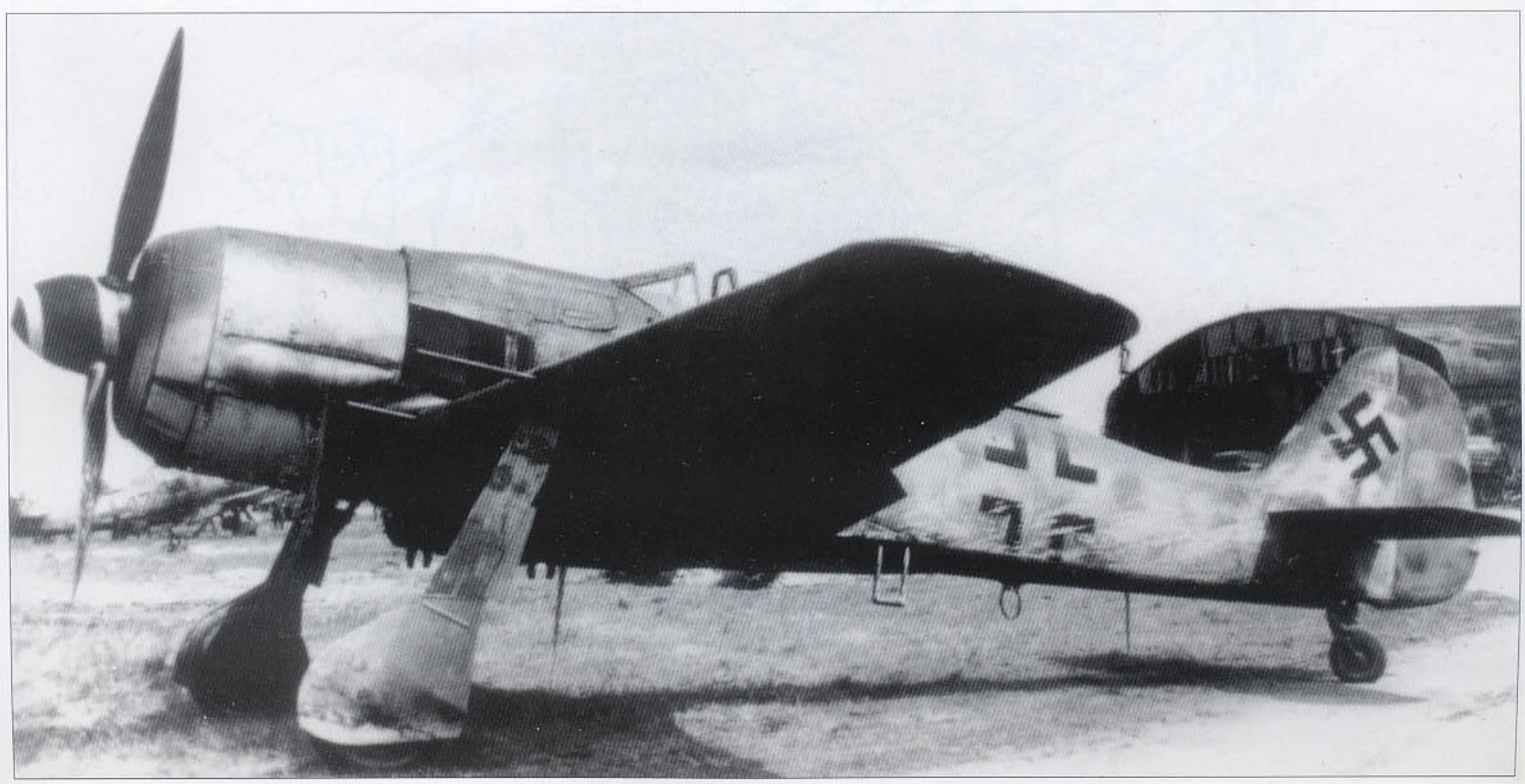


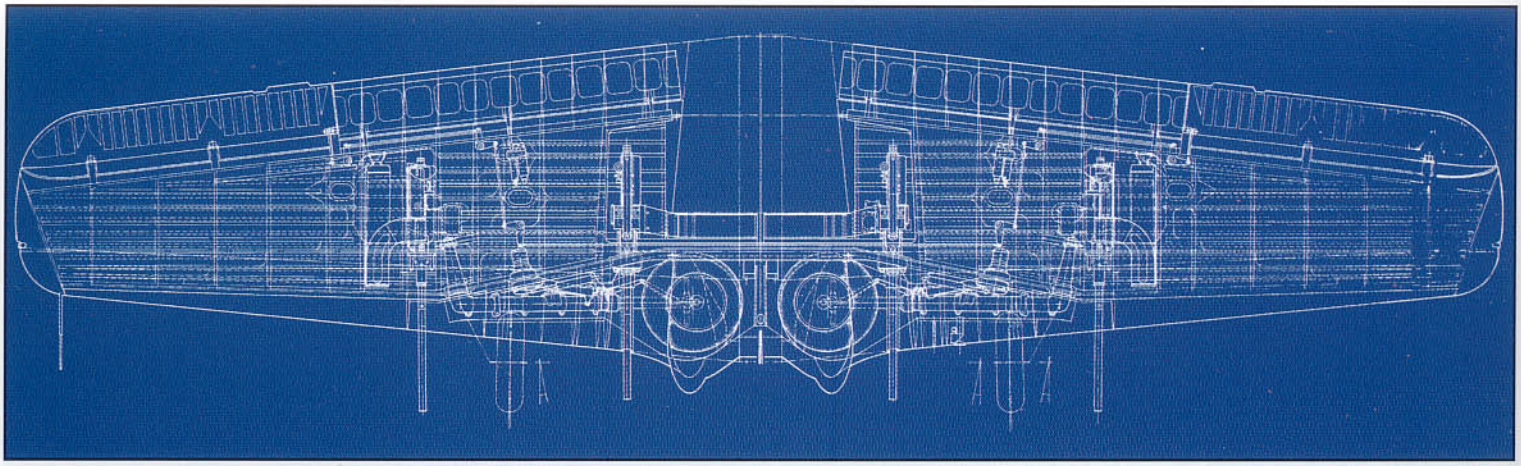


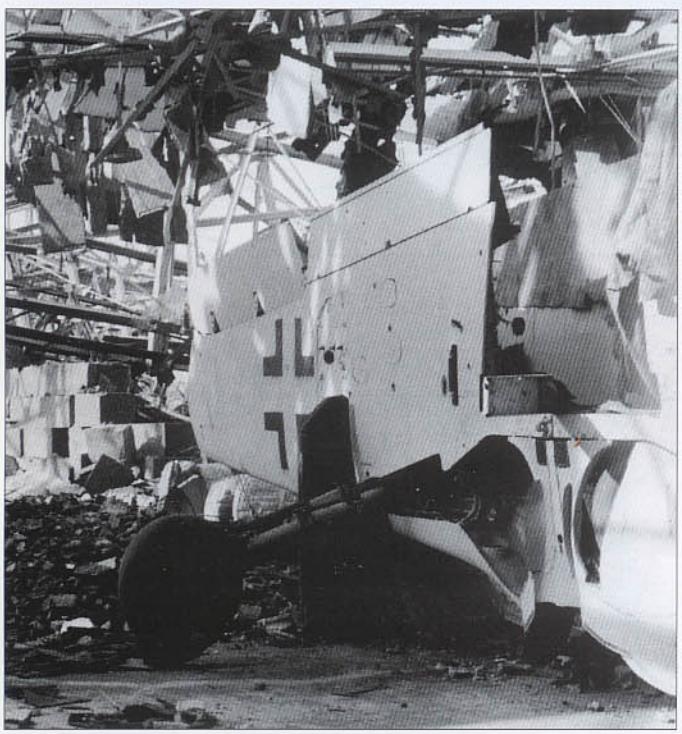
Right: Technically, the Fw 190 A-series were classified as fighters, but in reality many were routinely adapted to fulfill missions other than that of day fighters. Typically, the Fw 190 A-8 carried either a 300 litre auxiliary fuel tank, or a single 1,102 lb (500 kg) bomb beneath the fuselage on a special ETC 501 bomb rack. This bombload could be further modified by the use of a special ER-4 adapter rack, attached to the ETC 501, which would allow for up to four smaller bombs to be carried. In this configuration, the Fw 190 A-8 doubled as fighter and fighter-bomber. After D-Day (June 6, 1944), more and more fighters were assigned this dual role.

Below: This Fw 190 A-8, W.Nr.739533, red 6, of 1./JG 6 was one of several Fw 190s to land at Fürth airfield to surrender on May 8, 1945.







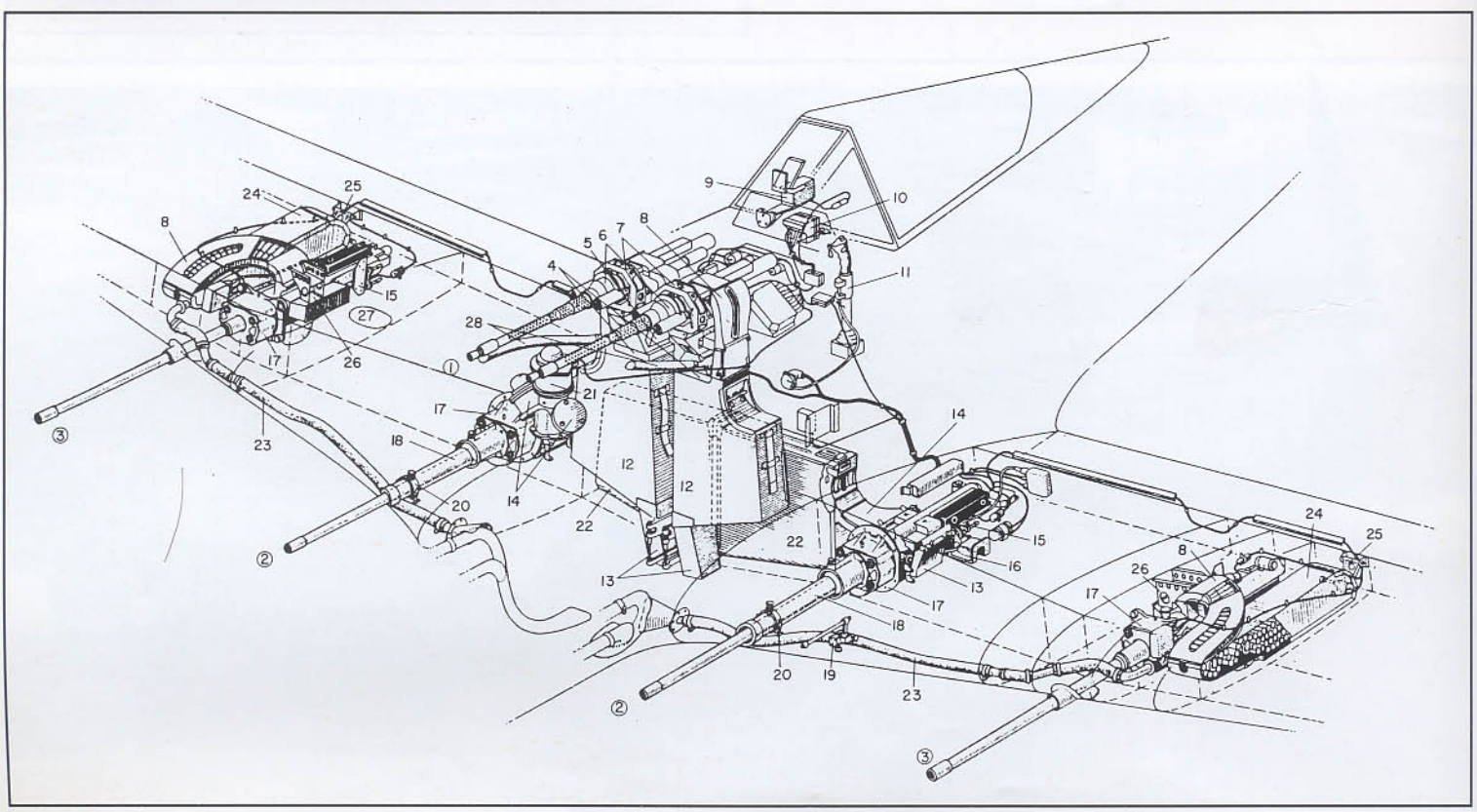


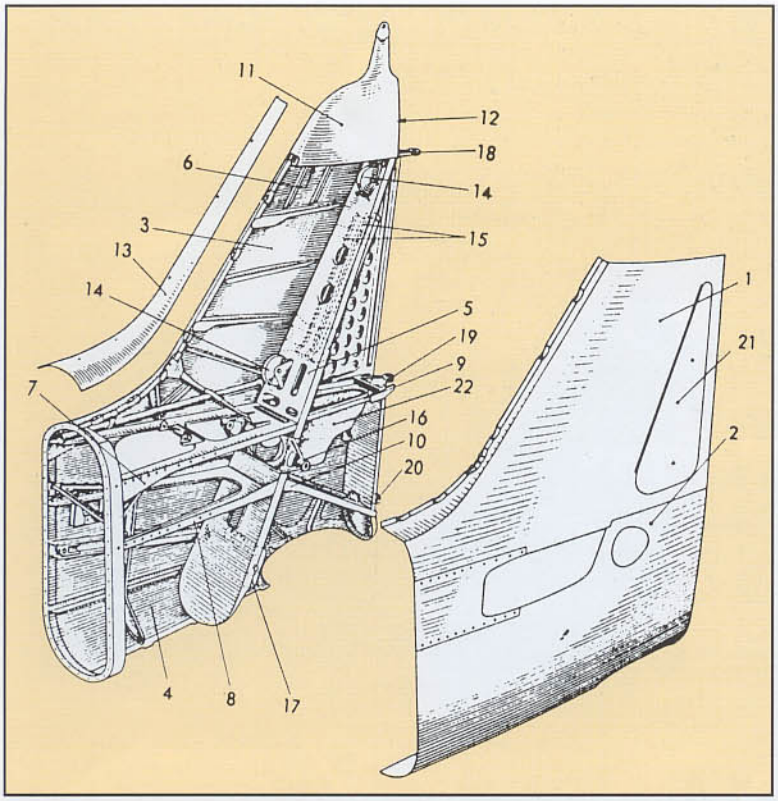
Above: An illustration of the basic wing for the Fw 190 A-8.
Left: Amid the wreckage of Focke- Wulf's Schwerin assembly facility, American troops came upon numerous newly completed Fw 190 A-8 wings. The landing gear for the Fw 190 A-8 was electrically operated.

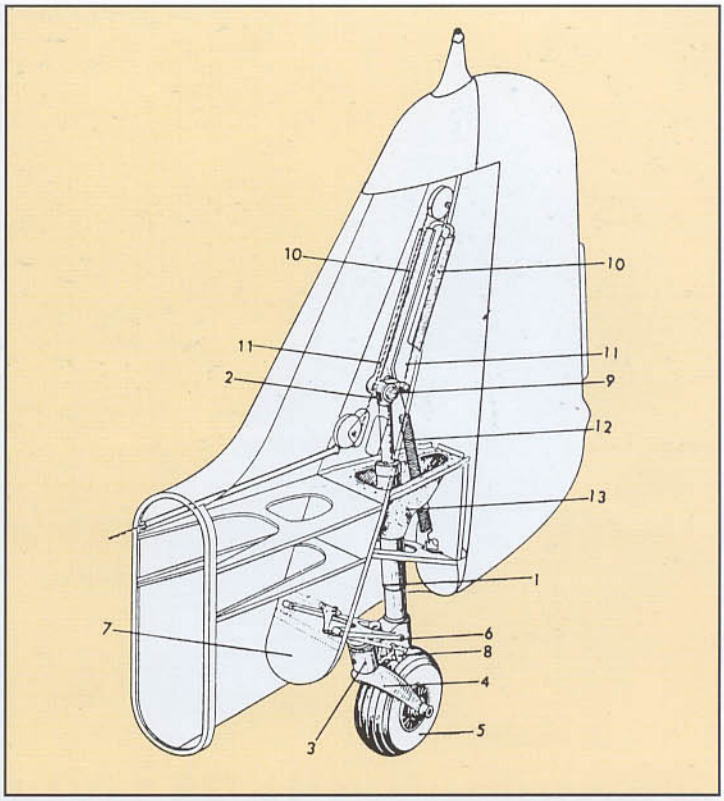
Below: Standard Fw 190 A-8 armament was heavy comprising two machine guns and four cannons.

Opposite page top: A detailed view of the metal vertical tail assembly and tail wheel unit.

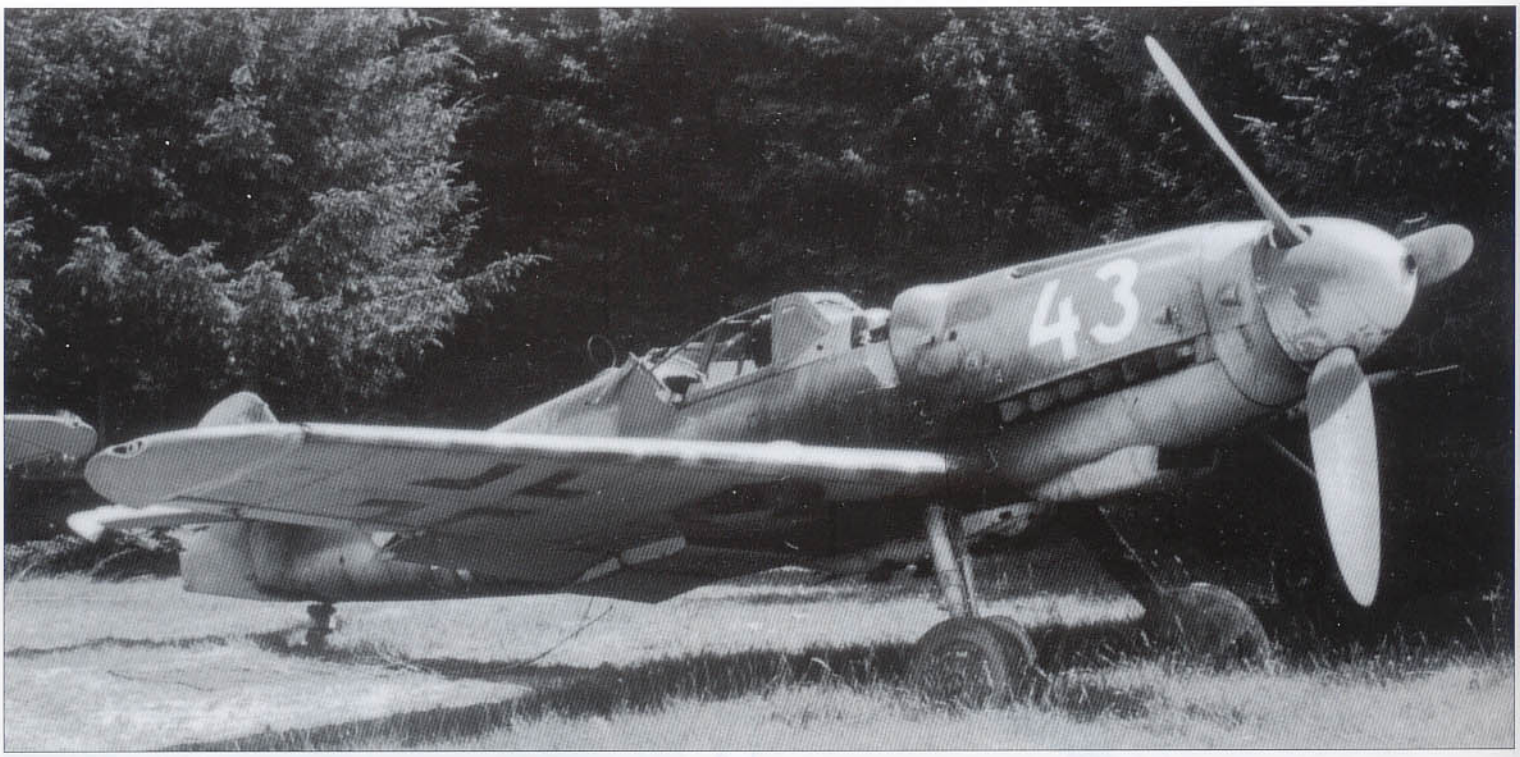
1. MG 131 machine guns (2)
2. MG 151/20E cannon
3. MG 151/20E cannon
4. Ammo box attachment brackets
5. Link belt ejection chute
6. MG 131 forward mounting
7. STL 131/5B weapon mounting
8. Ammo feed chute
9. Revi 16 B gunsight
10. SZKK weapon control unit
11. KG 13 B control grip
12. Ammunition containers
13. Link belt and spent shell discharge
14. Fuselage weapon synchronizing unit
15. Rear weapon mounting
16. Rear mounting support
17. Forward weapon mount
18. Cannon barrel cover
19. Hot air control module
20. Cannon support unit
21. Wing root cannon synchronizing
22. Wing root cannon ammo boxes
23. Hot air conduit for cannon warming
24. Ammo container
25. Ammo container rear support
26. Shell ejection chute
27. Shell casing access hatch
28. Cold air conduits for ammo cooling







A detailed illustration of the fuel system for the Fw 190 A-8 showing the 51 gal (193 ltr) forward fuselage tank immediately in front of the 64.5 gal (244 ltr) main fuel tank. The cylindrical tank located behind the main tank in the fuselage held either 25.3 gal (95 ltr) of C3 fuel or 18.7 gal (70 ltr) of GM 1 nitrous-oxide power boosting. Finally, a 79.3 gal (300 ltr) drop tank is shown on its underfuselage carrier.



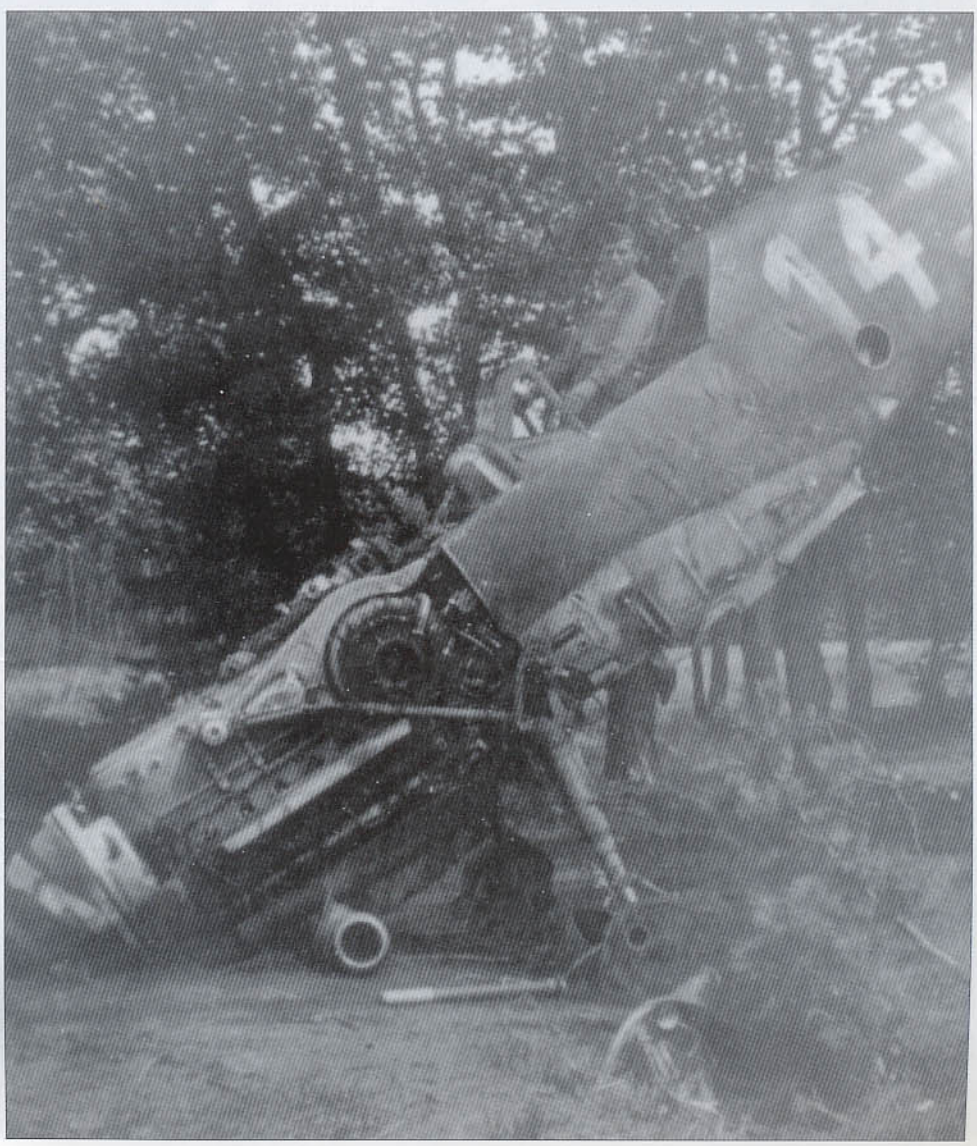
Messerschmitt Bf 109 G-14

The *Luftwaffe* began receiving the Bf 109 G-14 during June, 1944, and toward the end of August, 1944, the Bf 109 G-14/AS made its debut. The Bf 109 G-14 was very similar to the older Bf 109 G-6, but standardized several features which were previously only available as modification sets. It was powered by a DB 605 AM engine driving a VDM 9-12087 propeller and equipped with MW powerboost. Most examples of the G-14 received the new Erla canopy and many were equipped with the new FuG 16ZY radio and underwing Morane mast. The Bf 109 G-14/AS received the new DB 605 AS engine driving a VDM 9-12159 propeller and was otherwise similar to the G-14. Structurally, the Bf 109 G-14 was generally similar to the G-6, but the G-14/AS was distinguished by its redesigned cowl which enclosed the enlarged supercharger associated with the AS engine. Both variants of the G-14 were manufactured in substantial numbers and were eligible to receive a number of auxiliary equipment items designed to increase firepower, or range or adapt the type to special operations.

Above: A standard Bf 109 G-14, W.Nr. 463147, white 43, found at Messerschmitt's Lechfeld facility after the war.

Below: An abandoned Bf 109 G-14/AS found by US Army troops at Stendal.

Above: First Lts. Leonard C. Katzenmeyer and Zell Smith, Jr. of the USAAF 9th Tactical Air Command survey the remains of a Bf 109 G-14/AS late in 1944. Although the twin cowl-mounted MG 131 machine guns were removed by the time this photograph was taken, other features of the DB 605 AS engine are clearly visible including the enlarged supercharger and supercharger bearer arm associated with this powerplant. The DB 605 AS was produced in 1944 to increase the altitude capability of the DB 605 A, by substituting the standard supercharger with the larger unit from a DB 603 G. The "S" denoted *Sonder* (Special). First evaluated on a Bf 109 G-5, W.Nr. 26108, SL+RR, the DB 605 AS proved a success despite some minor exhaust penetration of the engine compartment. A new deep-chin oil cooler, SKF type Fo 987, was also fitted to AS-equipped aircraft after having been successfully evaluated on Bf 109 G-6/AS, W.Nr. 16550, KT+DX, in June 1944.

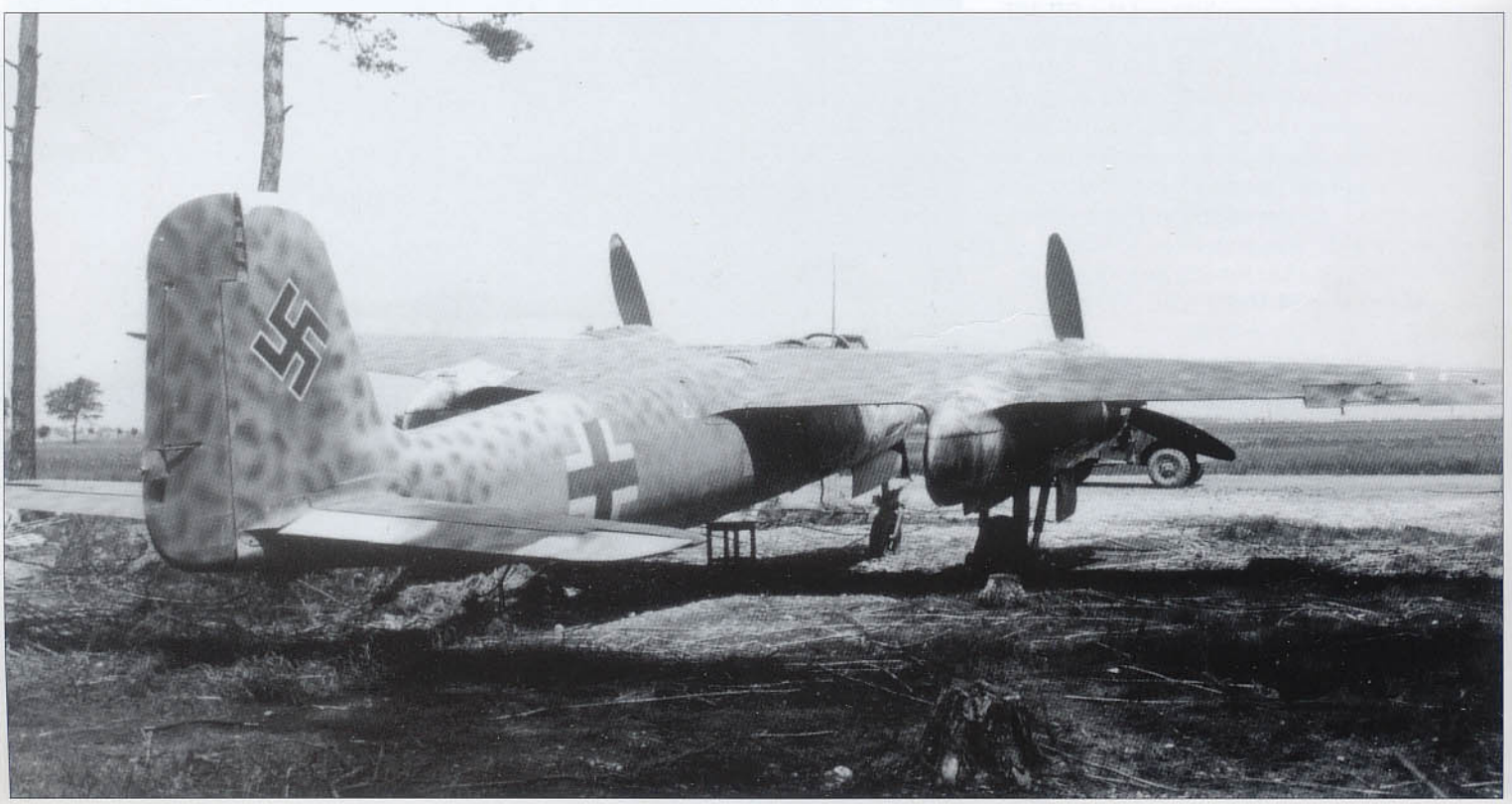


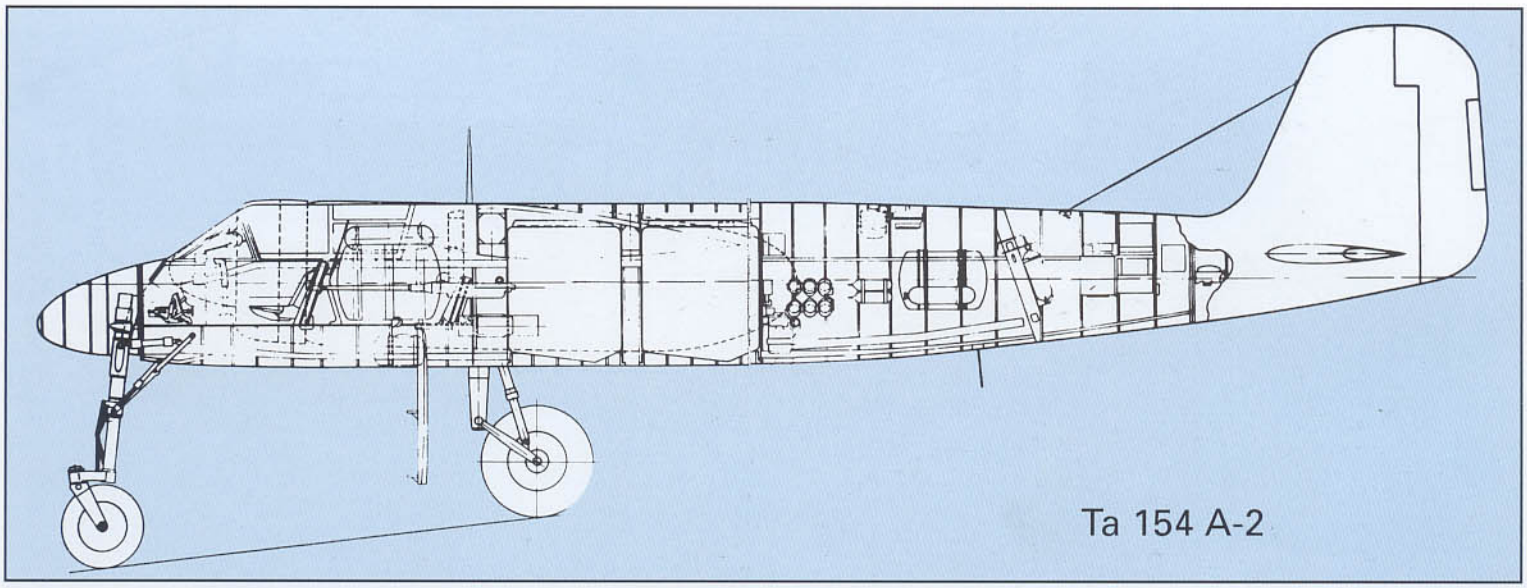
Right: The remains of another Bf 109 G-14/AS, white 14, of an unknown unit photographed somewhere in Germany after the war. The curved engine bearer arm for the AS engine is clearly visible.

Focke-Wulf Ta 154 A-1

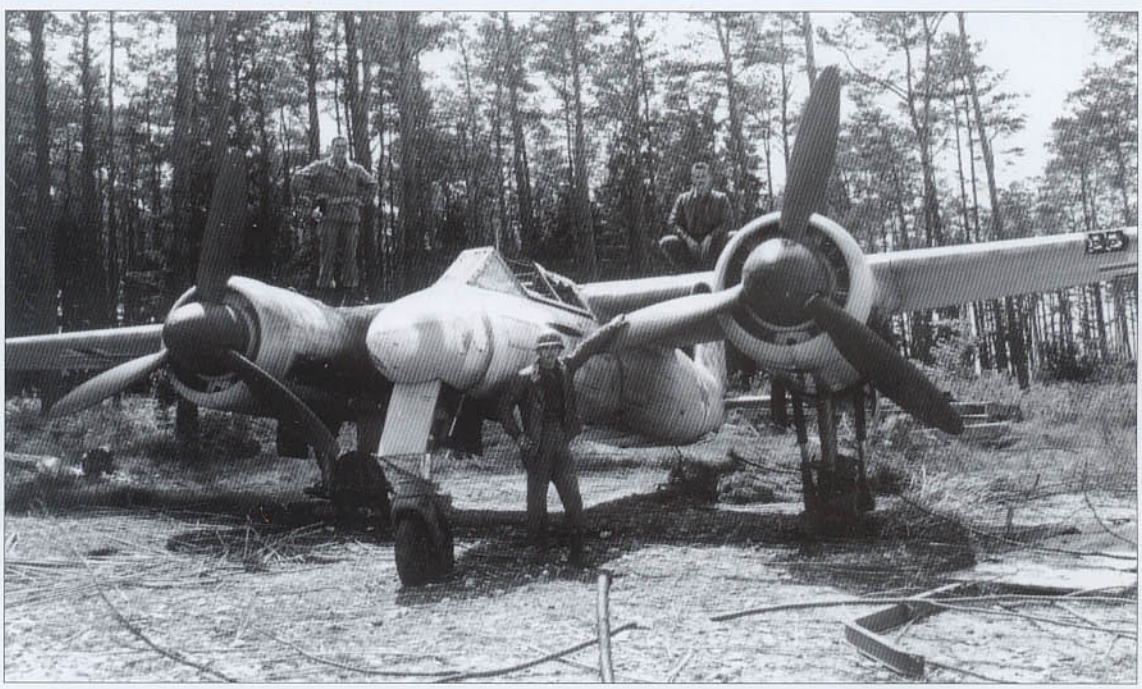
The Ta 154 is generally regarded as a wooden night-fighter design inspired by the remarkable British Mosquito. However, as with many German aircraft of this period, the basic design was adapted to fulfill more than one role. The Ta 154 A-4 night-fighter will be discussed in Volume 2. The Ta 154 A-1 was a two-seat day fighter which entered production at Posen during the last weeks of the war. It was outwardly similar to the night-fighter apart from the lack of airborne radar. Forward-firing armament consisted of two 20 mm MG 151 cannons, plus two 30 mm MK 108 cannons. Power was supplied by two Jumo 211N engines driving Junkers VS 9 wooden propellers. The exact number of Ta 154 A-1s built is unknown, but at least six were completed. The single-seat Ta 154 A-2 was generally similar to A-1 and was to have been produced at Posen, Erfurt and Breslau, although only four are known to have been completed.

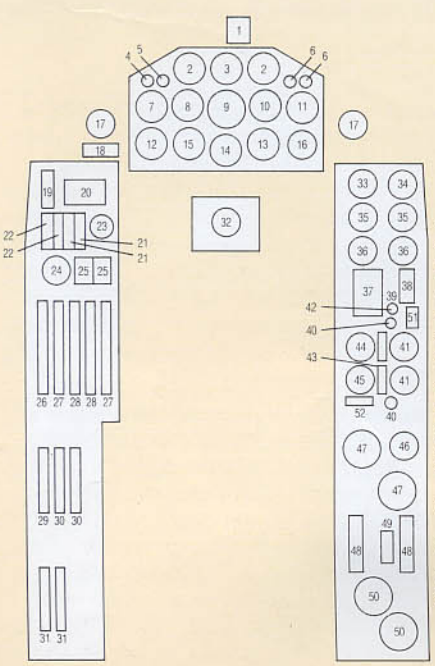
Above and below: This Ta 154 A-1, W.Nr. 320003, KU+SP, was found by American troops on the airfield at Lechfeld. In spite of the fact this was a day fighter, the distinctive camouflage was more in keeping with its better known night fighter variant, the Ta 154 A-4 (see vol. 2).



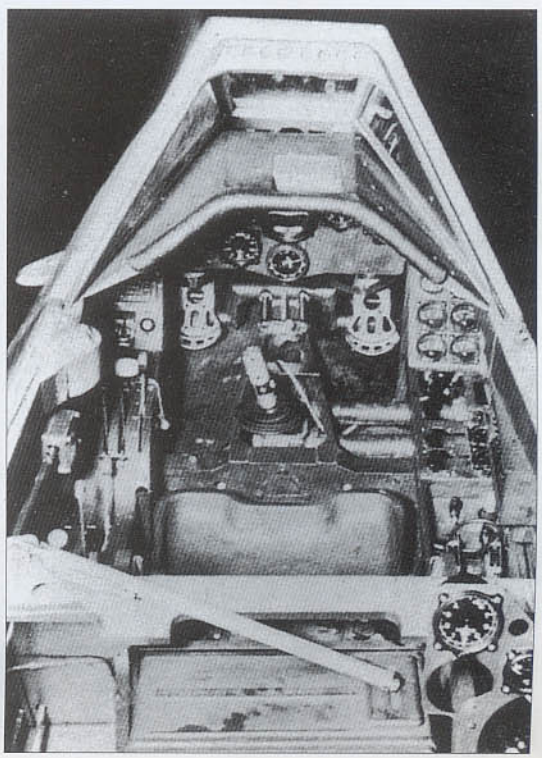


Right: Another view of the third A-1 completed, W.Nr. 320003. This aircraft was successfully flown by Focke-Wulf test pilot Hans Sander on July 1, 1944. Contrary to previously published articles, this particular machine was *not* crashed, or destroyed, by *Feldwebel* Werner Bartsch on June 30, 1944 as alleged. On this date, Bartsch was still in the hospital recovering from an earlier crash in the Ta 154 V9, W.Nr. 100009, TE+FM. Undoubtedly, if a crash did occur at the end of June in 1944, it must have involved another Ta 154, with a different pilot.





1. Revi gunsight
2. Tachometer
3. Double manifold pressure gauge
4. Empty - not for A-1 series
5. Pitot tube heat indicator
6. Fuel pump indicator
7. Empty - not for A-1 series
8. Airspeed indicator
9. Turn and bank indicator
10. Variometer
11. Magnetic compass
12. Electronic altimeter
13. Altimeter
14. Repeater compass
15. Fine altimeter
16. Auto direction finder
17. Fuel + oil pressure gauge
18. Undercarriage switch
19. Three-position switch
20. Gear + flap indicator
21. Prop feather control
22. Electric fuel pumps control
23. Emergency electrical system control
24. Dual hydraulic pressure gauge
25. Magneto switches
26. Throttle friction lock
27. Prop pitch controls
28. Throttles
29. Fuel tank selector switch
30. Fuel mixture controls
31. Empty - not for A-1 series
32. Clock
33. Oxygen indicator
34. Oxygen pressure gauge
35. Oil temperature gauges
36. Coolant temperature gauges
37. Ammunition round counters
38. Cabin warm air control
39. Cabin heat indicator
40. Low fuel warning lamp
41. Fuel contents gauges
42. Autopilot master switch
43. Autopilot emergency disengage
44. Gyro compass switch
45. Empty – not for A-1 series
46. Oxygen flow valve
47. Hydraulic system valves
48. Starter switches
49. Fuel selection switch
50. Engine cowling flaps
51. Cabin heat control
52. Windscreen defog switch



Messerschmitt Me 262 A-1a

On April 19, 1944, the first production example of the Me 262 was completed. Known as the Me 262 S1 (*Serien* 1 - Series 1), this aircraft was the forerunner of the Me 262 A-1a day fighter. Soon thereafter, full production Me 262 A-1a's began to appear. These were powered by two Junkers Jumo 004 B-1 turbojets delivering 2,000 lbs (910 kg) thrust at sea level. The lower-case "a," used as a suffix, denoted the designated engine as the Jumo 004. The Me 262 A-1b was a proposed variant powered by two BMW 003s, but only three of these aircraft were completed.

Although the He 280 held the distinction of being the world's first jet-propelled fighter, the Me 262 was the first operational jet fighter. Early in the Me 262's operational career, an important meeting, which was held at Hitler's Berhtesgaden home, focused attention on the role of the Me 262. The *Führer* demanded the Me 262 be adapted forthwith to a ground-attack role. The opposition countered that this was a misuse of the revolutionary aircraft and held the opinion that it was more urgently needed as strictly a fighter. In truth, there was much to be said for both arguments. To Hitler, it was essential the coming invasion be stopped before a foothold could be achieved. Using aircraft as bombers in the ground-attack role had great merit. On the other hand, the *Luftwaffe* saw the new weapon as an effective means of bringing down large numbers of Allied bombers before they could reach their targets. When the invasion of Europe actually began in early June 1944, so few Me 262s had been accepted by the Luftwaffe, that their presence over the beachhead would have had little impact on the outcome.

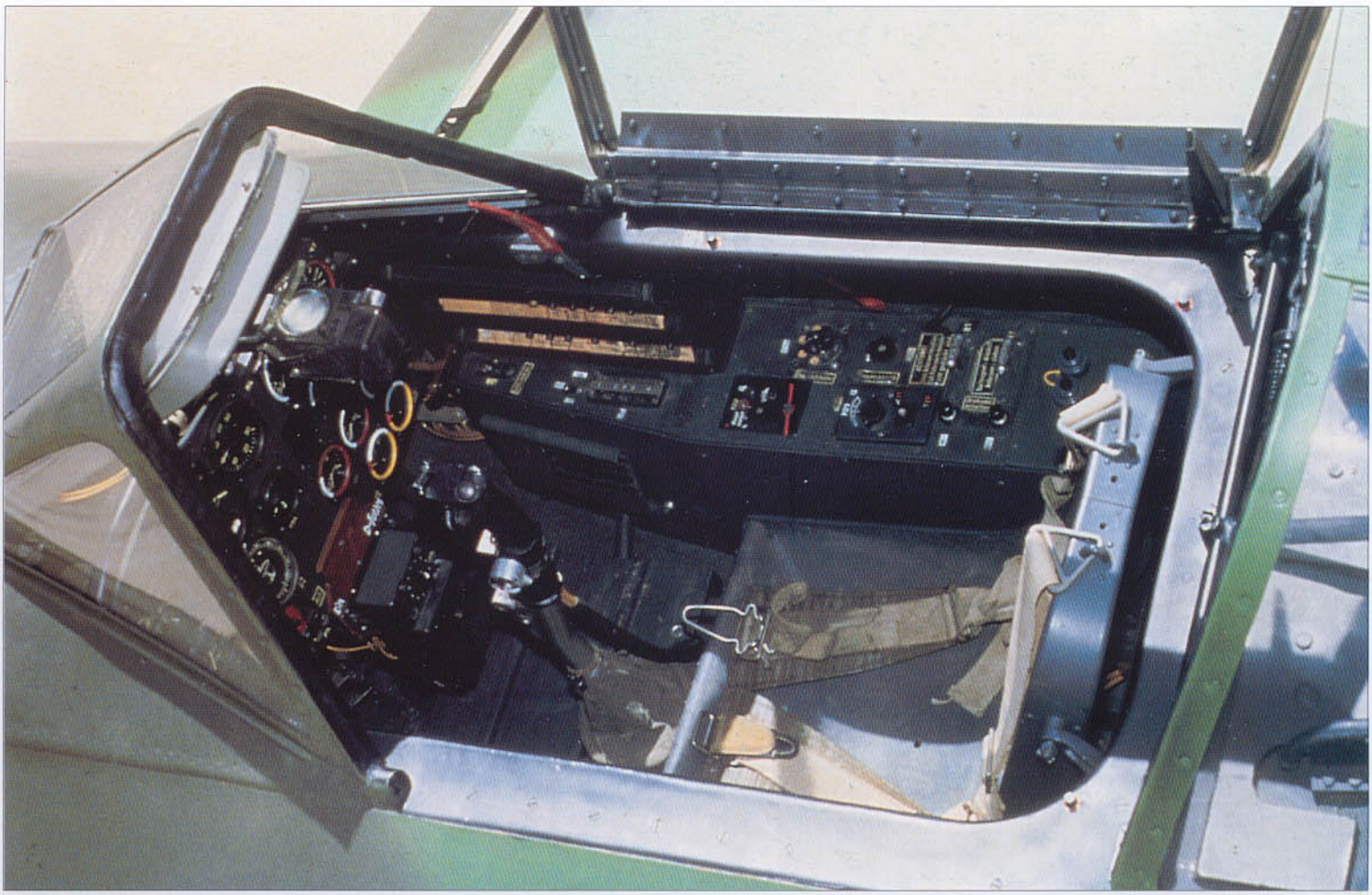
By July, 1944, the Me 262 was scoring its first victories, and by August, the new fighter was being delivered to more units. By September 29, 1944, some 30 new Me 262 A-1a fighters had been received by *Kommando* Nowotny. On October 3, 1944, this unit flew its first operation, but the very next day, two Me 262s were lost in landing accidents. However,by November 1944, after claiming the destruction of 22 Allied aircraft while sustaning a loss of 26 jet fighters, the unit was withdrawn from action.

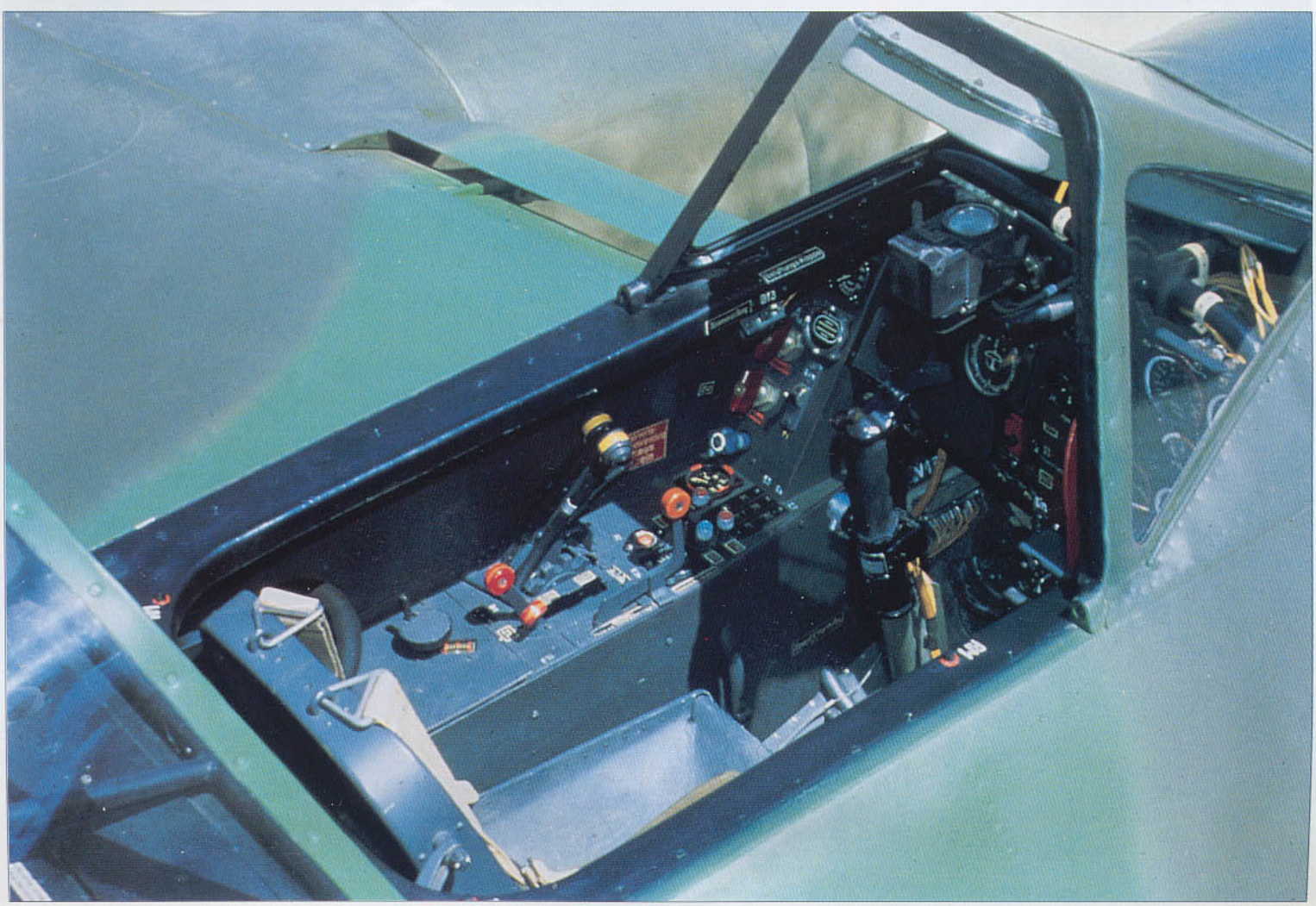
Other units were formed, new pilots hastily trained, and production of the Me 262 was decentralized. New tactics were devised to take advantage of the jet's strengths, while instructors cautioned young pilots to avoid close dogfights, since the Me 262's low, flat, turning circle rendered it ineffective. Fuel consumption for all of the early jets was relatively high, but the Me 262's engines were designed to operate on a low grade of fuel known as J2 which was akin to diesel oil. Despite the jet engine's radical nature, not as many service problems were experienced with the engines as might have been expected. Nevertheless, the average Jumo 004 required a compete overhaul in just over 25 hours, although many pilots were able to greatly extend this by careful handling of controls.

Production of the Me 262 A-1a was undertaken at several locations including Augsburg, Leipheim, Schwäbish Hall and Obertraubling. Others were recycled from minor production centers such as Lechfeld, Memmingen and Landshut. A total of 1,933 Me 262s were completed before the end of the war.

Above: Photographed upon completion on April 10, 1979, at the Garber Restoration Facility of the National Air and Space Museum (NASM), located in Silver Hill, Maryland, is this superbly restored Me 262 A-1a/R7, W.Nr. 500491, yellow 7, of 11./JG 7. Produced in 1945 at Messerschmitt's Obertraubling facility, the aircraft was captured at war's end and shipped to the Wright Field where it received Foreign Equipment number FE-111. After years in storage, restoration of this significant warplane began in 1977. Today, it occupies a prominent location within the Jet Gallery of the NASM in downtown Washington, DC.

Opposite page top and bottom: Two views of the cockpit of W.Nr. 500491, showing not only the thoroughness of the restoration, but also the main features of the cockpit. In contrast to earlier Messerschmitt single- seat fighters, visibility from the cockpit of the Me 262 was exceptional. Note the special rocket arming panel added to the lower center of the main instrument panel. This aircraft was equipped with a total of twenty-four R4M air-to-air rockets mounted beneath the wings (as *Rüstsatz 7* - Auxiliary apparatus 7). When fired, these 55 mm rockets rippled off in 50-milliseconds from their wooden and metal launching rails.



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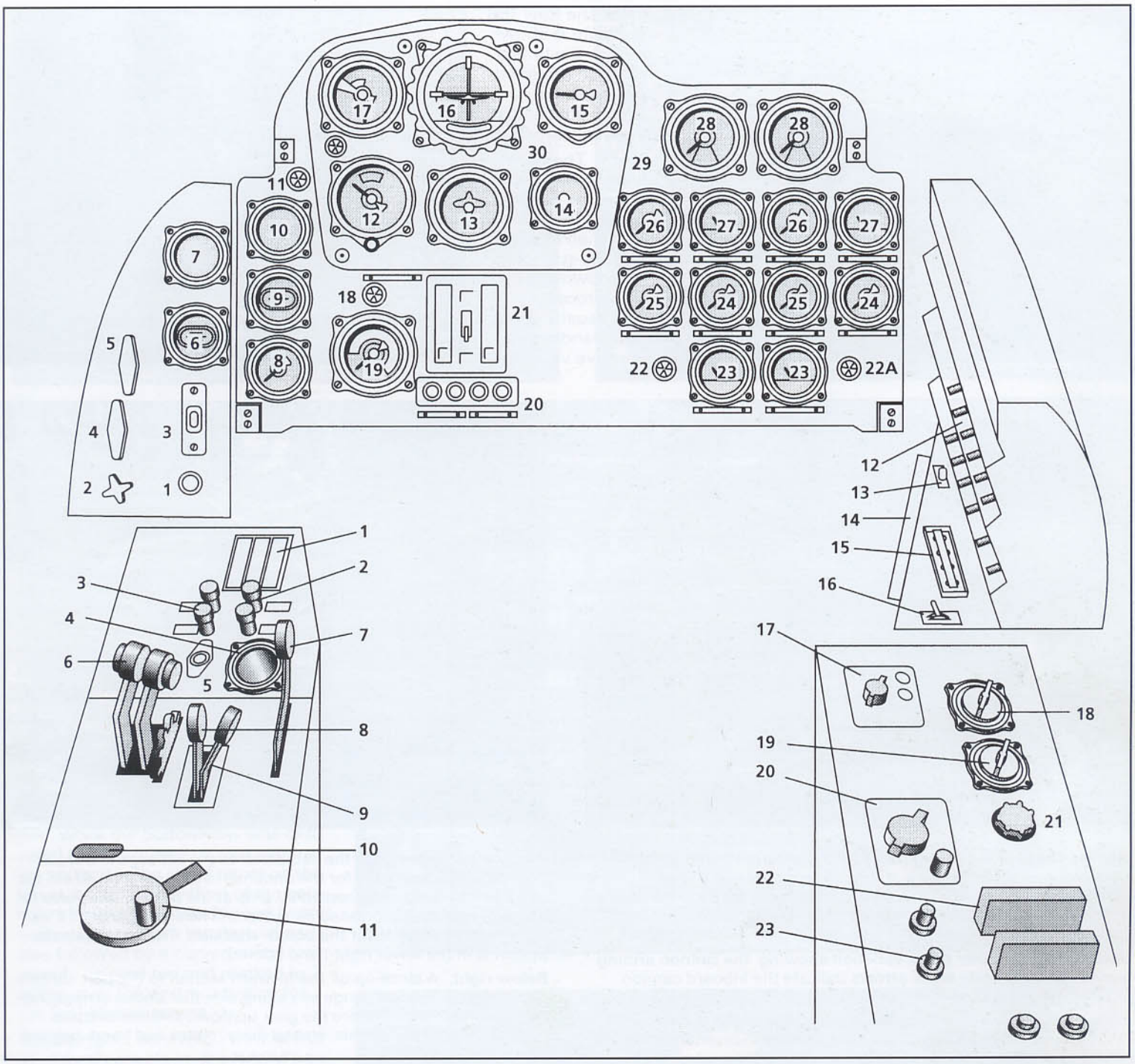


Left opposite: It is interesting to compare the instrument arrangement found on the NASM Me 262 with what was officially proposed for the type as shown above. As with all German fighters of the period, there existed many minor variations depending upon equipment carried and the mission of the aircraft.

Me262 A-1 Instrument Panel

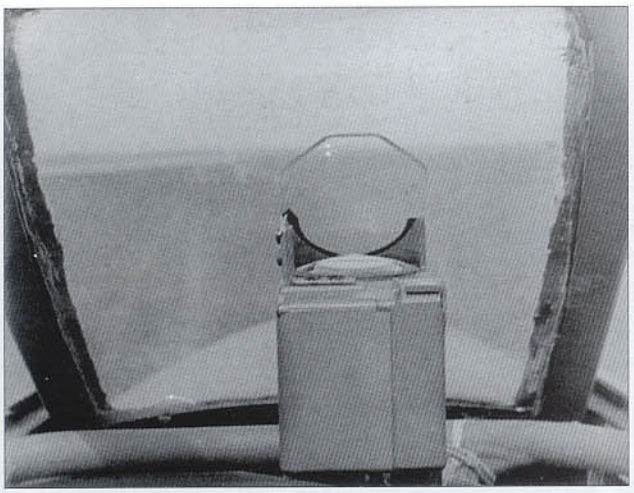
1. Oxygen breathing tube connection
2. Oxygen shutoff valve
3. RATO release switch
4. Emergency landing flap control
5. Emergency undercarriage control
6. Chronometer
7. Pressurized air gauge
8. Oxygen pressure gauge
9. Oxygen monitor
10. Altitude monitor
11. Mach warning lamp
12. Altimeter
13. Repeater compass
14. AFN-2 indicator
15. Variometer
16. Turn and bank indicator
17. Airspeed indicator
18. Cabin pressure warning lamp
19. Cabin pressure indicator gauge
20. Weapons control lamps
21. SZKK 2 ammo counter
22. Forward tank low fuel warning lamp
23. Fuel contents indicator
24. Oil pressure gauge
25. Fuel injection temperature gauge
26. Fuel pressure gauge
27. Fuel temperature gauge
28. RPM indicator
29. Main instrument panel
30. Blind flying instrument panel

LEFT CONSOLE

1. Undercarriage indicators
2. Undercarriage switch
3. Landing flap switch
4. Tailplane trim indicator
5. Battery cut-off switch
6. Throttles
7. Tailplane trim adjustment
8. Fire safety cock lever
9. Fuel lever detent
10. Plug for flight suit heater
11. Rudder trim wheel crank

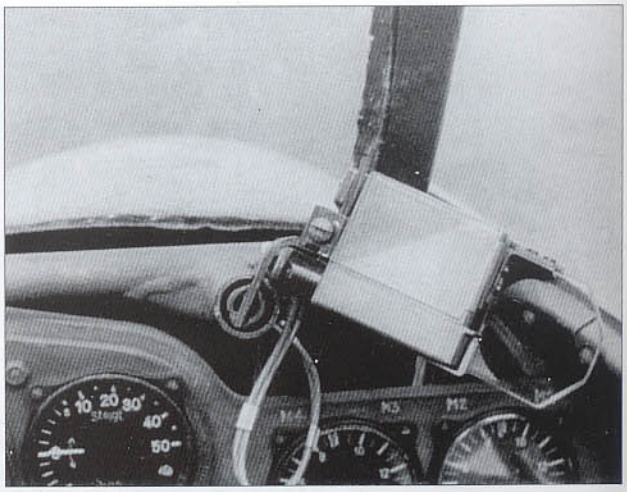
RIGHT CONSOLE

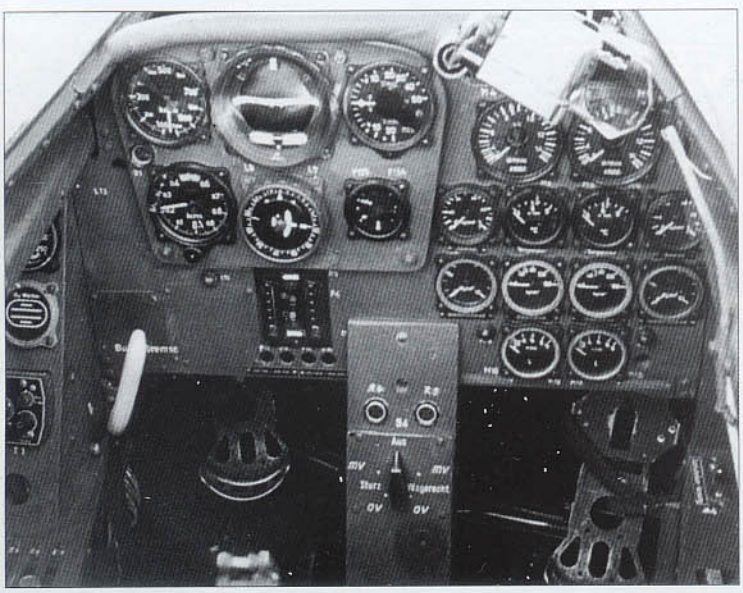
12. Main switch board
13. Signal flare select switch
14. Map case
15. Signal flare control box
16. FuG 25a detonator box
17. FuG 25a control unit
18. FuG 16y operating switch
19. Frequency switch for FuG 16y
20. Connection box for AD 16y
21. Frequency control for FuG 16z
22. Starter control switches
23. Coupling for pilot's helmet leads

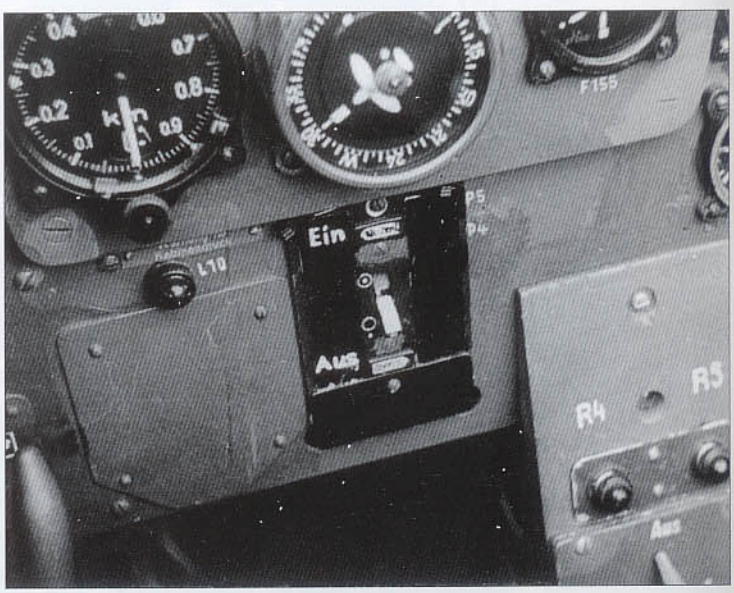


Left: The Revi 16B gunsight is shown here in the firing position mounted on its tubular frame attached to the main panel.

Right: The gunsight was disengaged by pulling it toward the pilot and then moving it to the starboard and downward. This procedure was usually done upon landing to improve visibility.





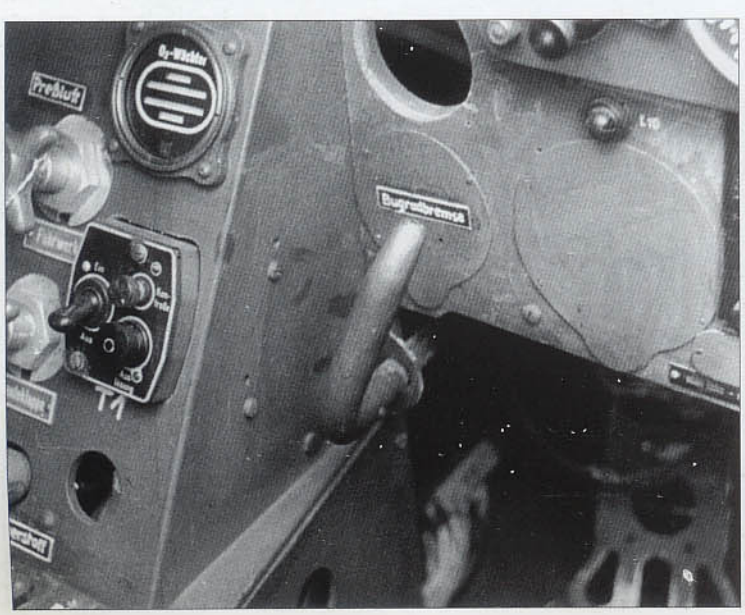


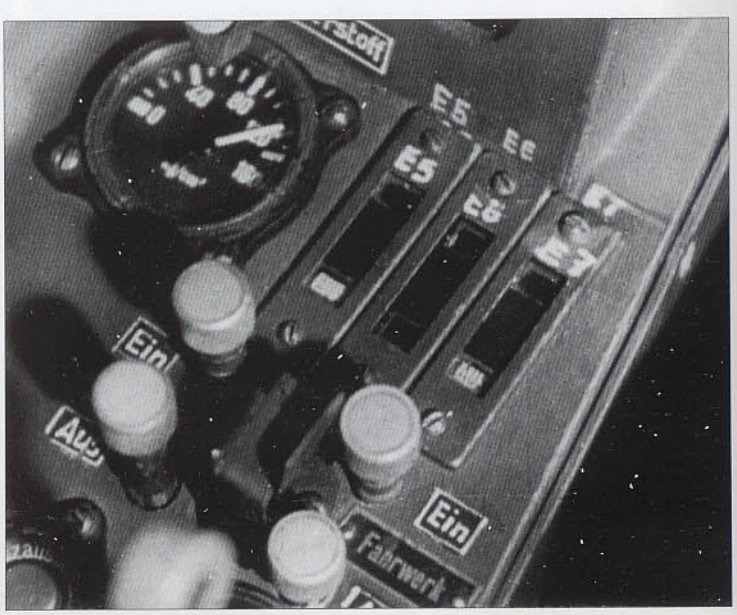
Above: Detail of the fusing panel for the external bomb load; the switch allows selection for a diving (*Sturz*) attack or a level (*Wagerecht*) attack. The arming indicator lights for each bomb are at the top of the panel. The arming panel for the nose-mounted cannon can be seen just to the left, below the blind flying panel.

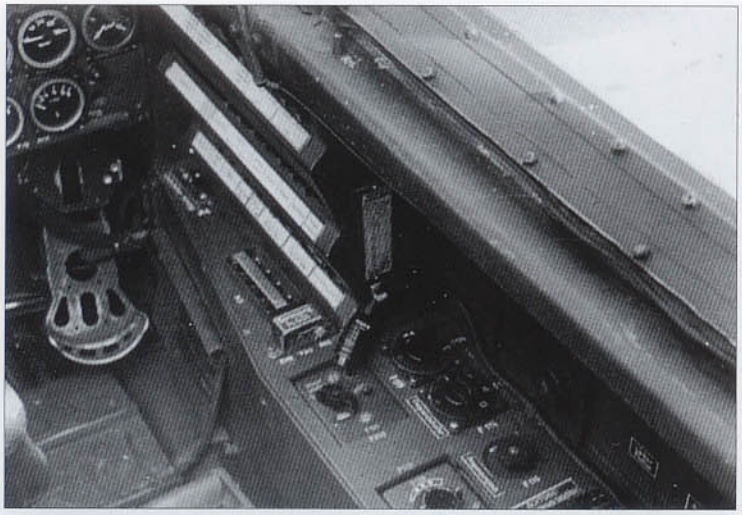
Above right: Another detail variation showing the cannon arming panel. The two white block arrows indicate the inboard cannon (top) and the outboard cannon (bottom) ammunition counters.

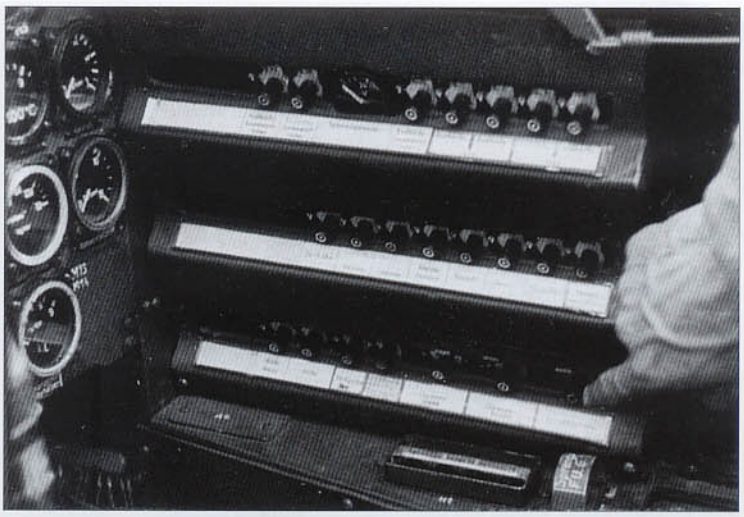
Below left: Yet another variation in the shape of the instrument blanks. This aircraft has provision for another instrument above the blank bearing the black & white decal reading *Bugradbremse* (Nosewheel brake). On the sub-panel to the left are the oxygen flow indicator, the valve for the undercarriage compressed air, the valve for the flaps compressed air and, at the bottom, the valve for the emergency compressed air system. The small panel "T1" is the electrical selector for the bomb shackles. The bomb release button is in the lower right-hand corner.

Below right: A close-up of the forward section to the port console. The oxygen pressure gauge sits along side the undercarriage indicator. Below the latter are the gear up/down selector buttons. Note the mixture of decals, etched metal plates and hand painted signs.







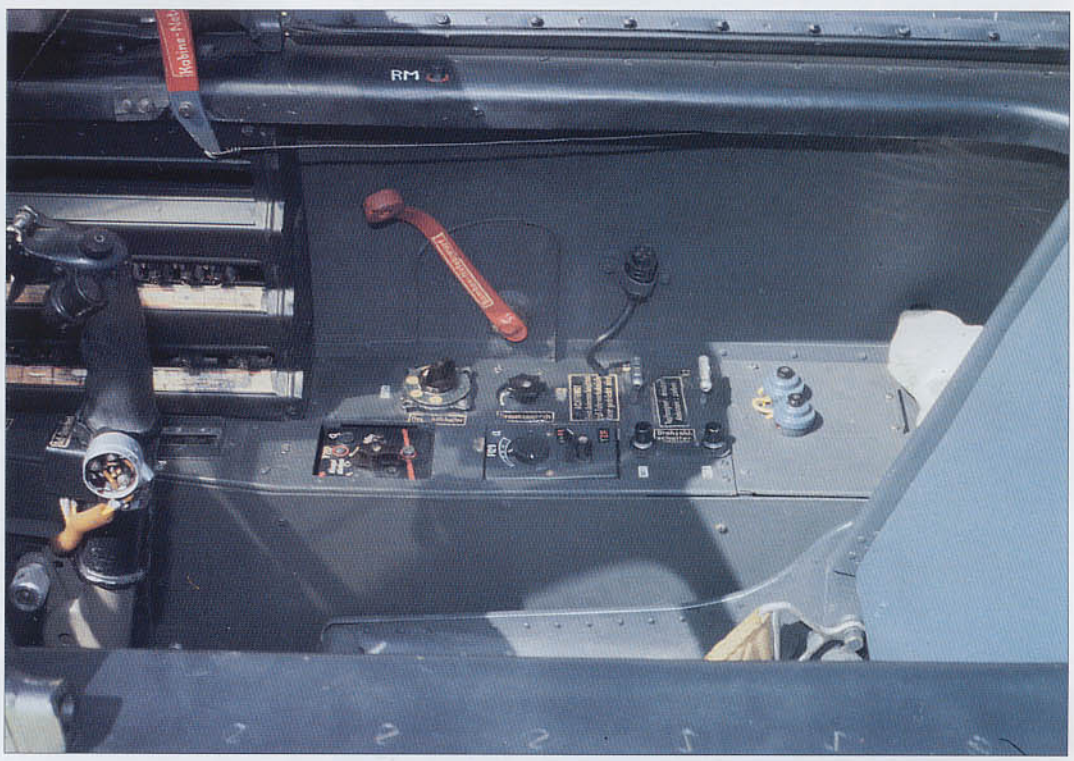


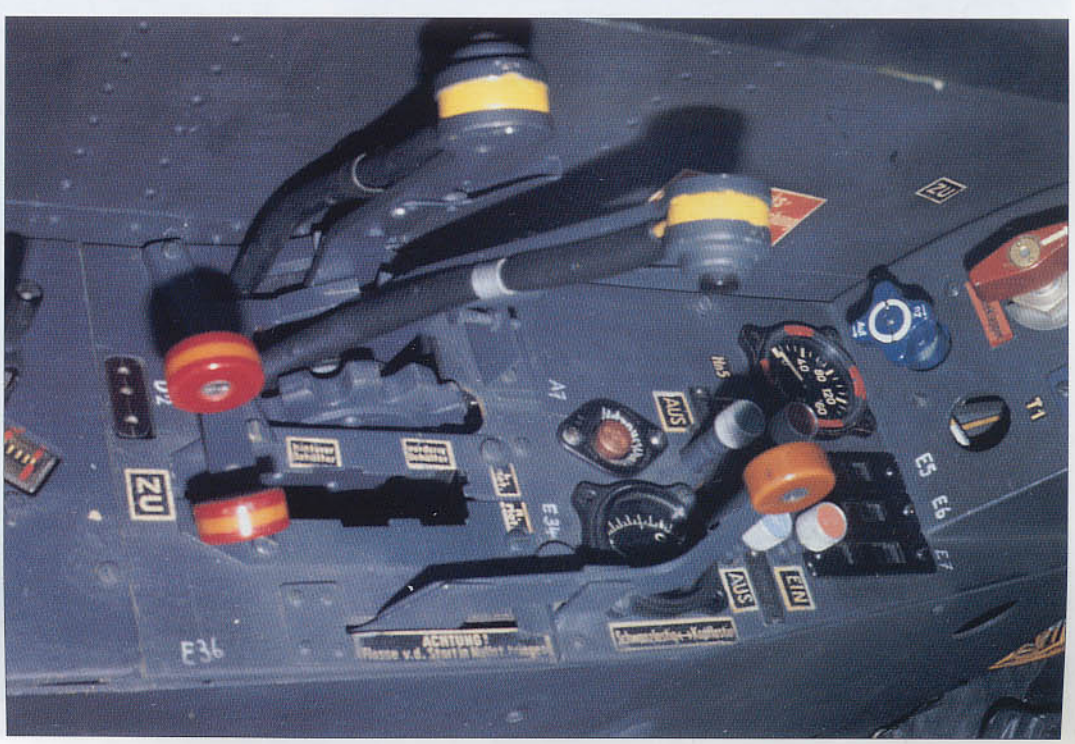
Above: A view of the forward starboard console. The map stowage case can be seen near the rudder pedal. On this particular aircraft, the windscreen heater button is still fitted. At the center of the console are the radio controls and the microphone plug lead. The frequency selector switches are in the back corner section with the on/off switch and volume controls on the inboard panels. The frequency selector chart is mounted vertically above the microphone plug lead.

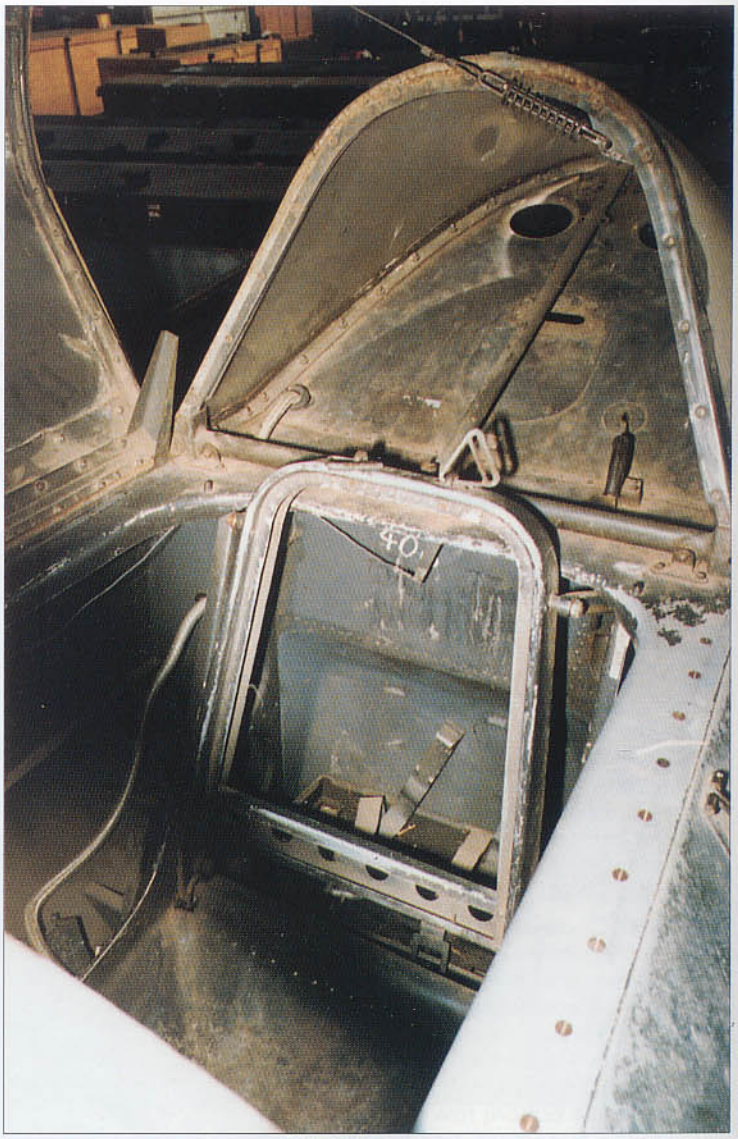
Top right: Close-up of the forward starboard console containing the circuit breaker panel with its built- in voltmeter. The top row houses the circuit breakers for the fuel and oil systems, and the center line for radio and blind flight instrumentation, while the bottom row was dedicated to the armament and generator systems. The small panel on the lower, horizontal, section of the console blanks off the windscreen heater switch. Aft of it are the flare selectors followed by a curved metal shield, painted red and marked in white, over the destruct button for the FuG 25 equipment.

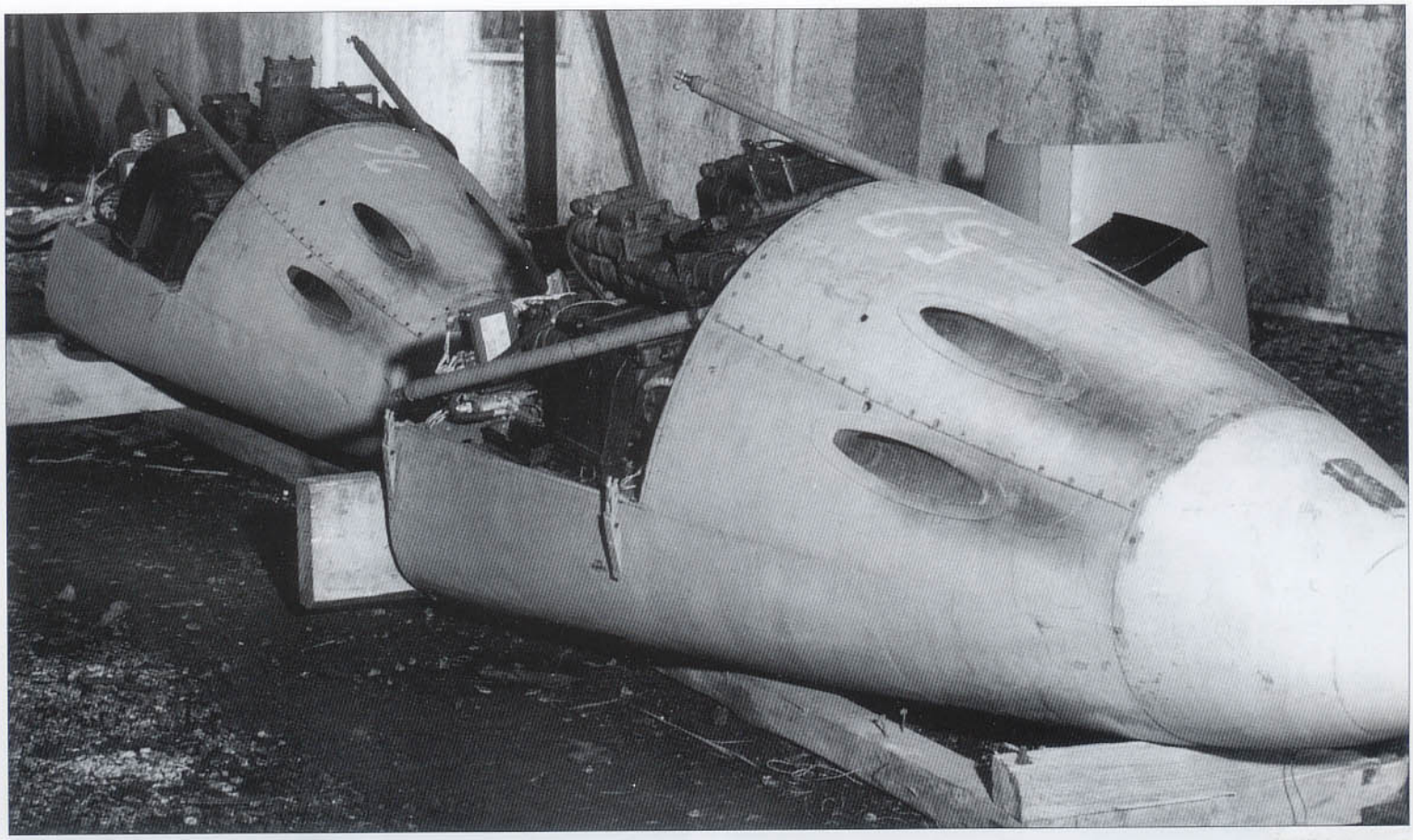
Middle right: An overall view of the starboard console in the NASM's aircraft showing the red emergency bomb/drop tank release handle in the center, and the red emergency canopy release handle and cable to the top.

Right: Close-up of the power controls showing the throttles with push button starters mounted on ends of the knobs. Also shown are the switch lever for fuel cock battery, the tailplane adjustment lever and indicator.





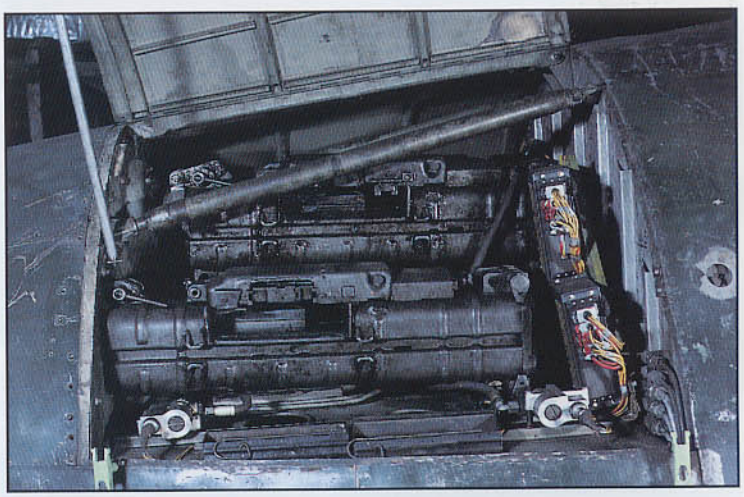


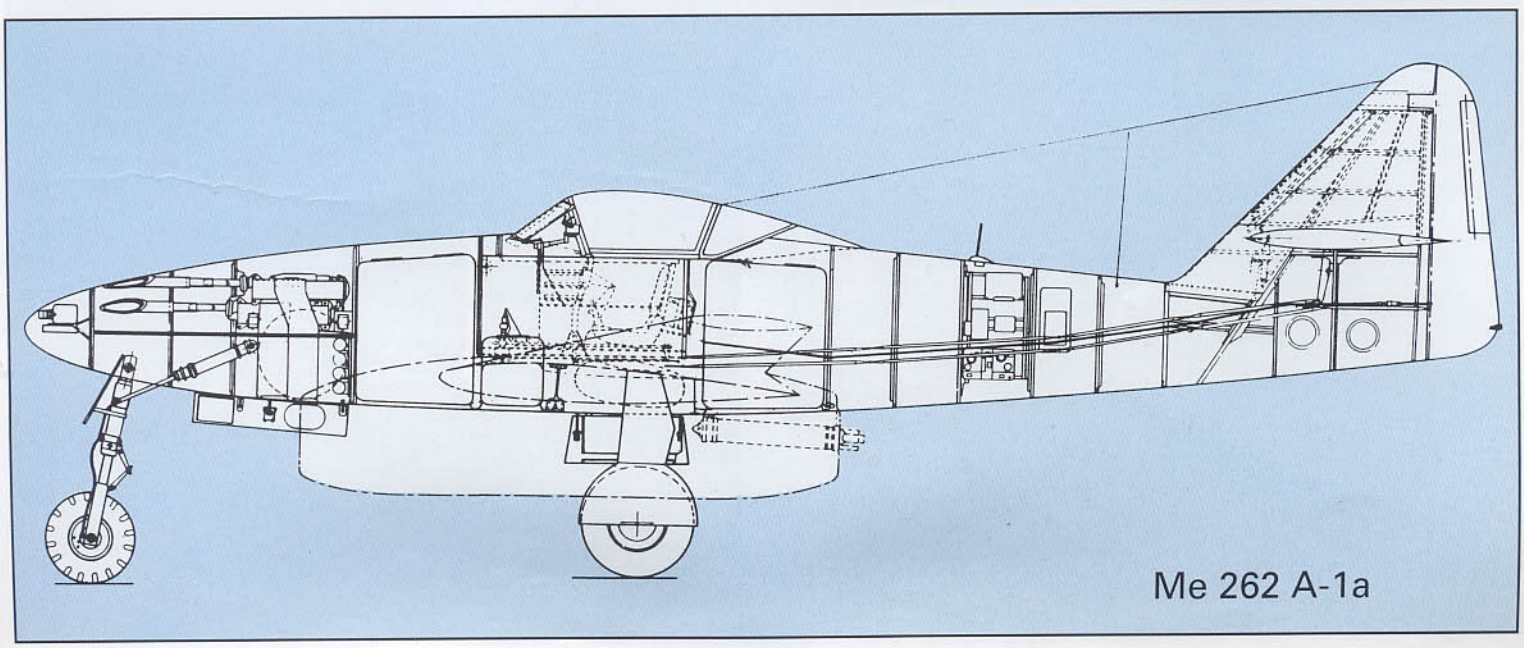


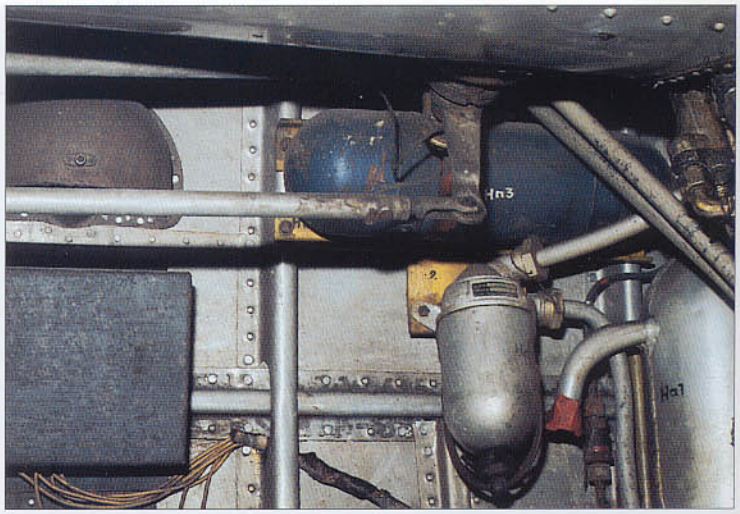
Opposite top left and right: A view of the seat area for Me 262 A-1a/R6, W.Nr. 500200, black X, during stripping down for full restoration in Australia. The continuous half-barrel shaped cockpit liner is visible because the side consoles have been removed. Note the channel section attached to the lower edge of the hinged section of the canopy. This prevents damage to the rubber seal on the port side of the frame. The tubular frame of the fixed rear section can be clearly seen. In an emergency, this canopy section would be jettisoned.

Opposite left: Close-up of Me 262 A-1a, W.Nr. 111711, showing the supplemental shoulder and head armor fitted to some late production aircraft.

Above: Two newly completed nose sections found at Obertraubling, Germany. Note the blast marks indicating that each MK 108 cannon has already been test fired. With an armament of four 30 mm MK 108 cannons, the Me 262 packed a devastating punch.



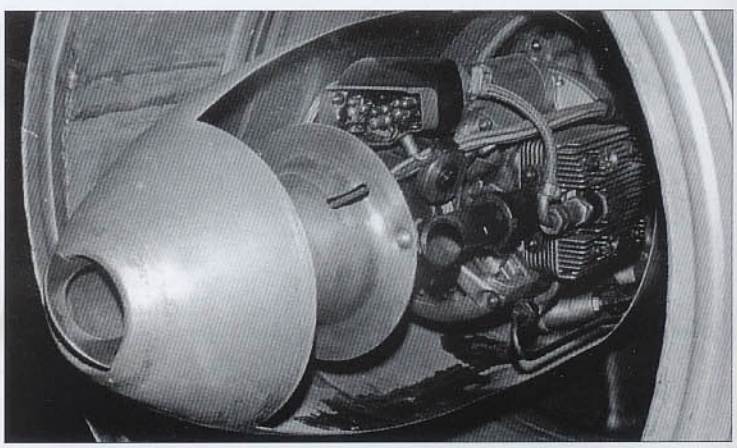


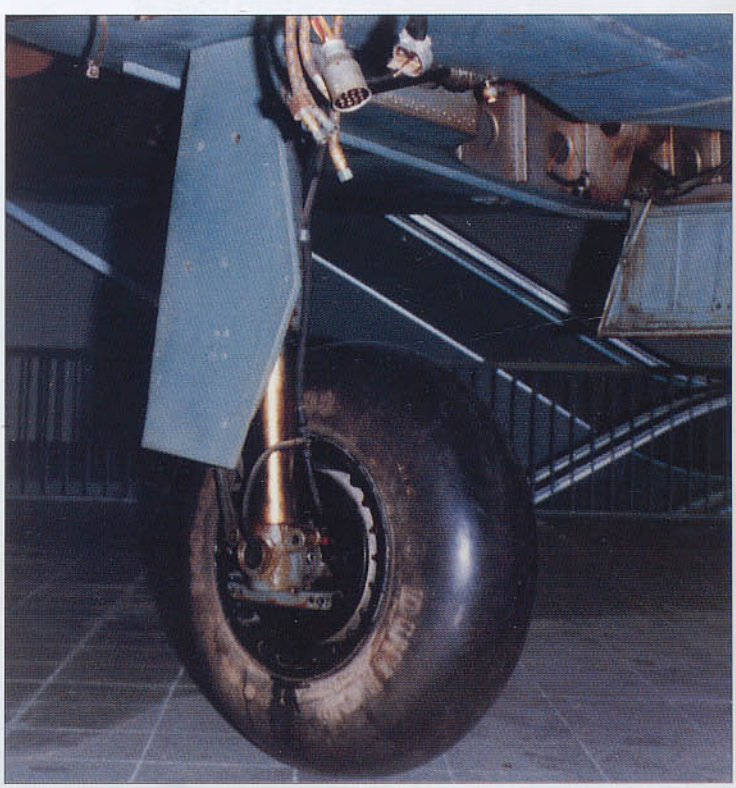


Left, lower left and bottom: Three views of the Me 262's undercarriage. Note that on this aircraft (NASM), the nosewheel compression leg lacks torque scissors.

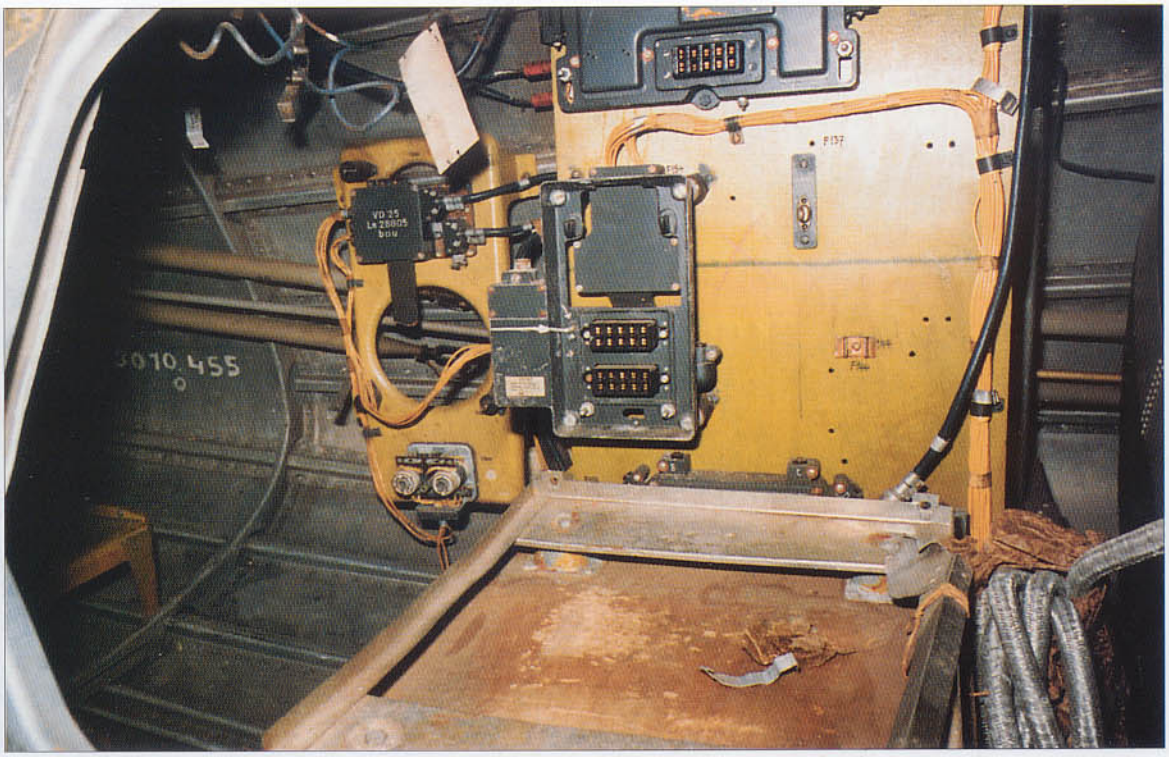
Above: A close-up of the compressed air tank in the lower portion of the weapons bay.

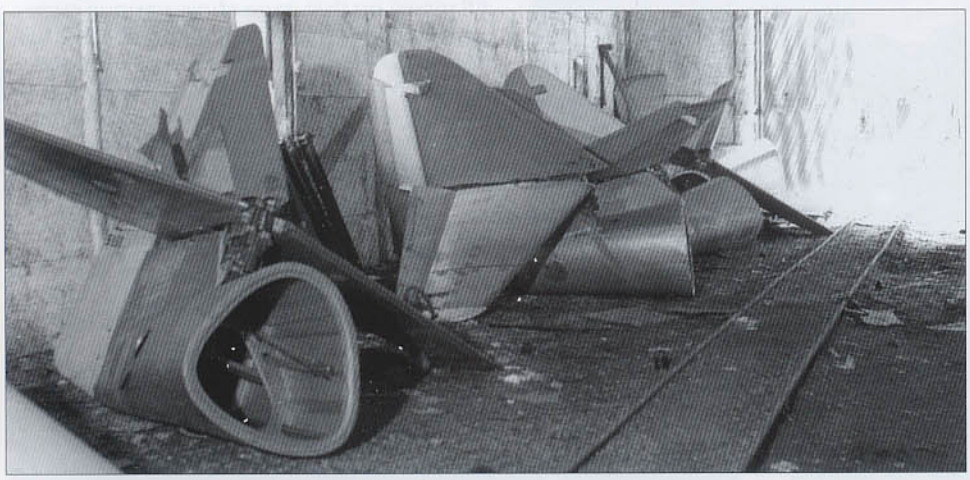
Below: Close-up of the exposed Riedel starter motor enclosed within its bullet-shaped housing in the center of the jet intake. Note the lanyard handle at the tip which, when pulled forcefully, started the motor, and this in turn, started the turbojet.





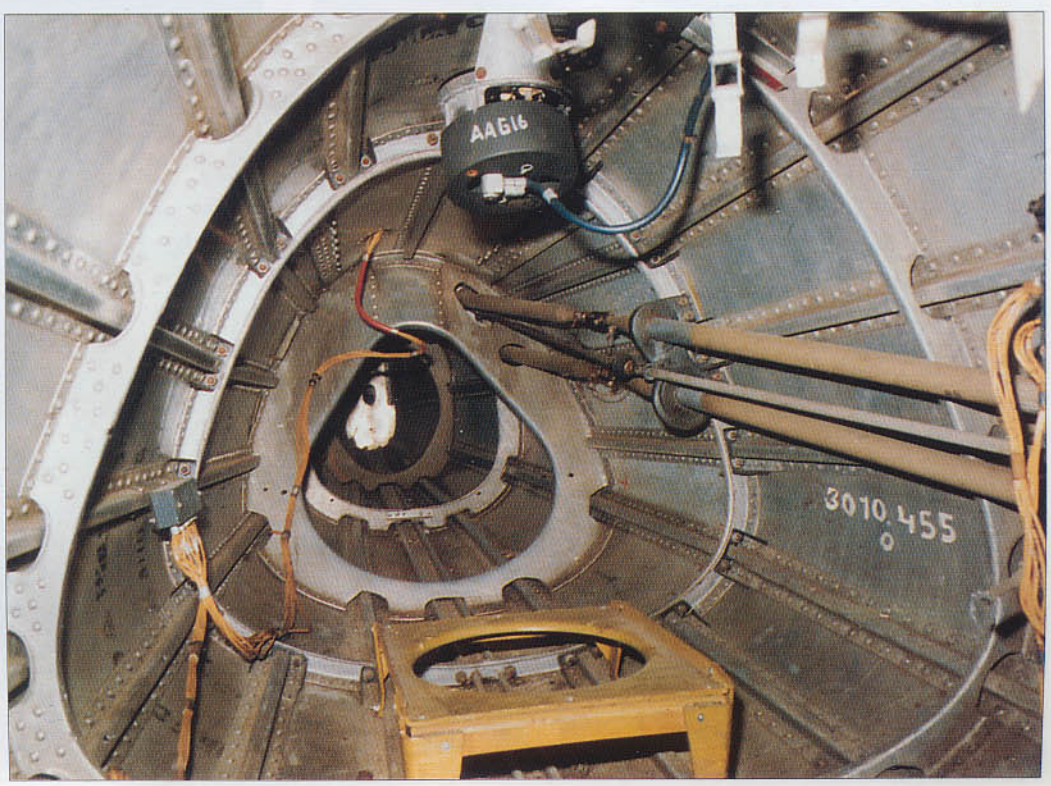
Right: A view inside the fuselage of Me 262 A-1a/R6, W.Nr. 500200, shows the radio equipment panels and supporting frames aft of the cockpit. The interior was bare metal but all panels and fittings were painted.

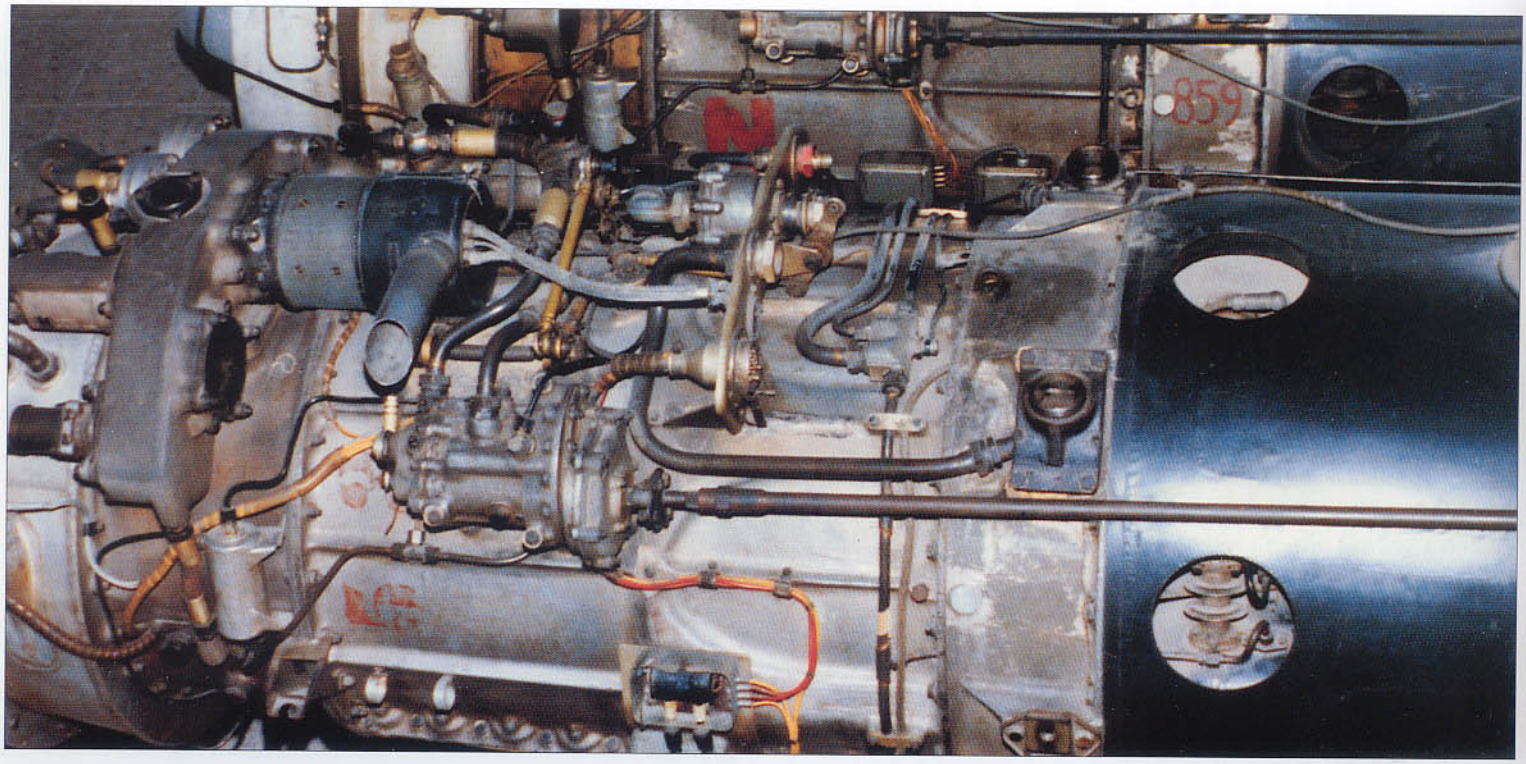


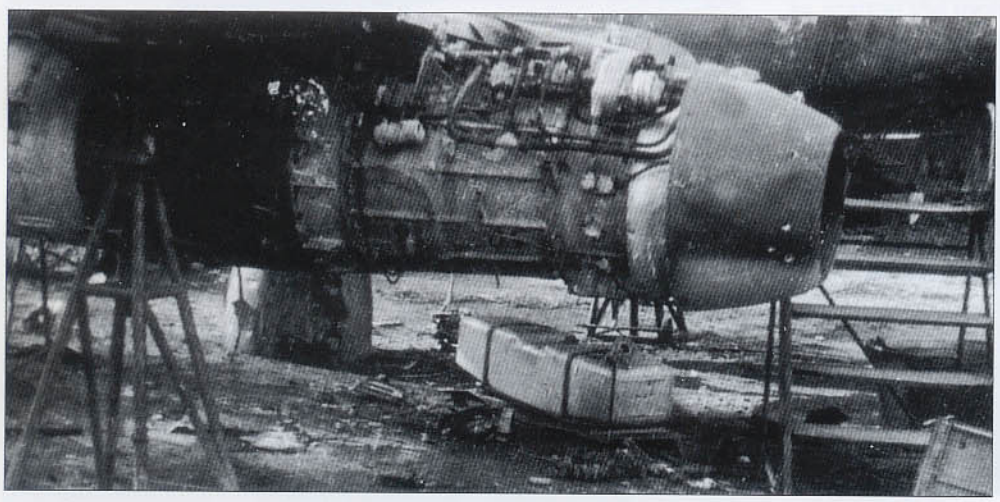


Left: A view inside one of the prefabricated assembly halls at Obertraubling showing completed tail units awaiting final assembly. The casual placement of these components is in distinct contrast to the advanced level of engineering which went into the Me 262.

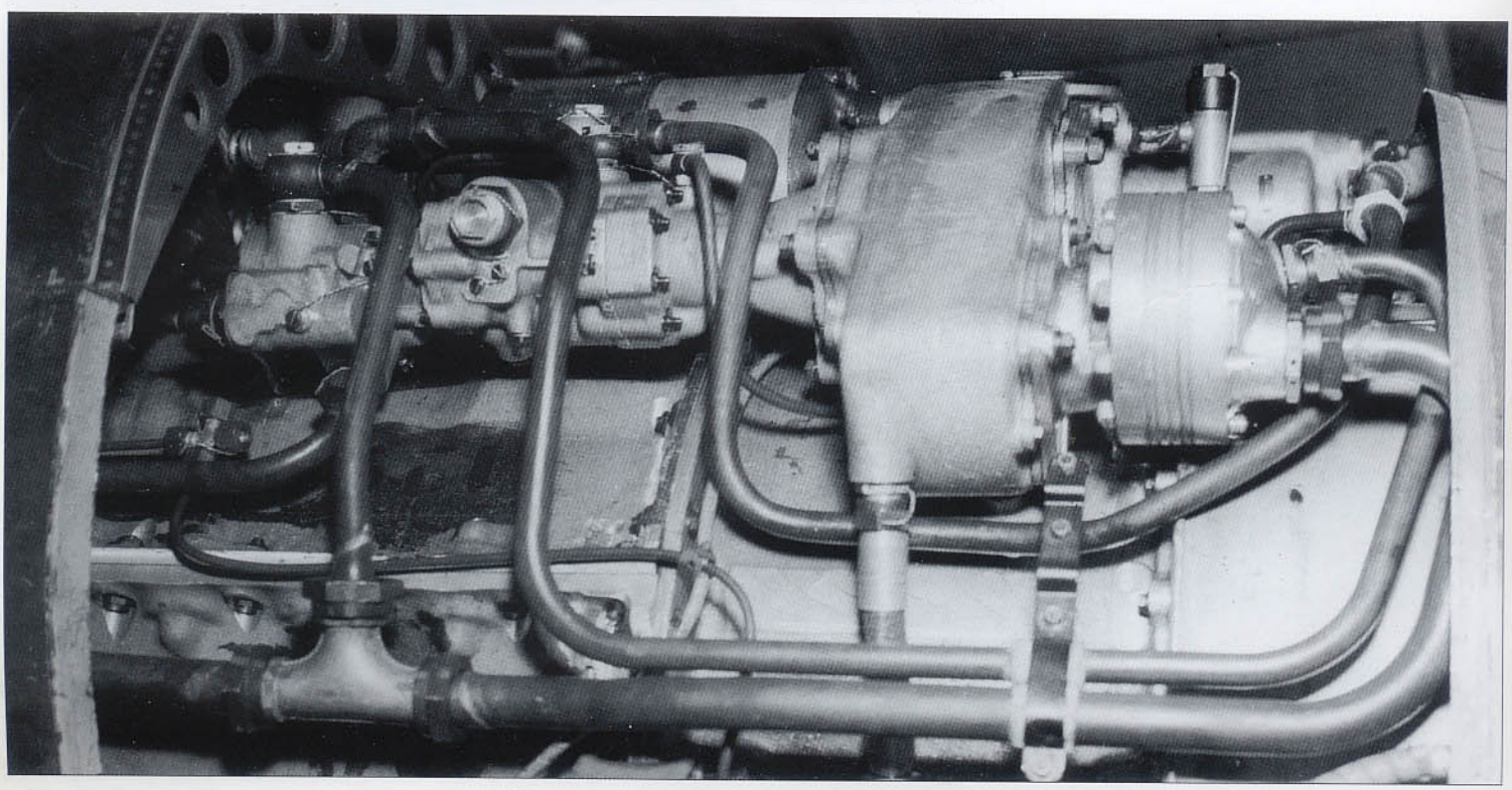
Right: Looking aft through the radio access hatch to Me 262 A-1a/R6, W.Nr. 500200. The floor mounted frame is for the master compass (see p. 23). Above it, is the control motor for the direction finding loop position on top of the fuselage (see p. 169). The torque tubes for elevator and rudder control and trim tab, run along the port side. The wiring harness along the starboard side leads to the electrically operated tailplane adjustment motor. Black numbers painted on the interior skin, is the makers code for the type of Duralumnum sheeting.

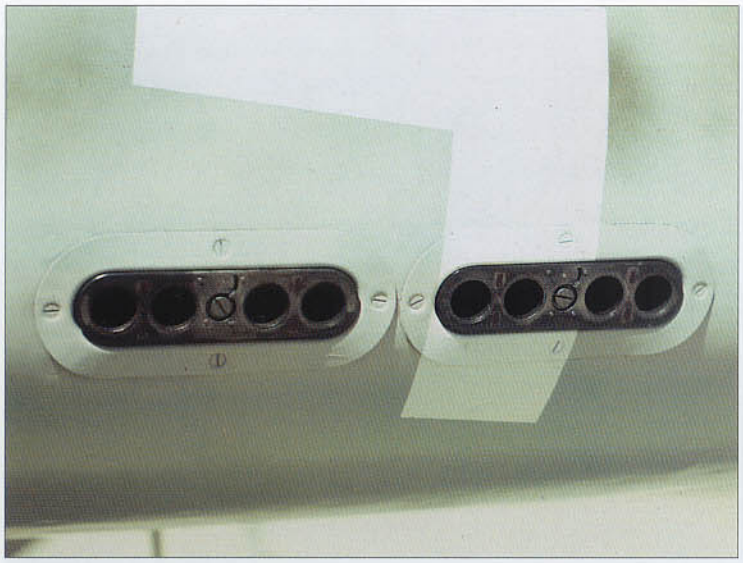






All views on this page show various close-up component details of Jumo 004 B-1 turbojets. The engine at the top of the page is from Me 262 A-1a/R7, W.Nr. 500071, now on display at the Deutsches Museum in Munich. The other views are from aircraft which are no longer in existence.

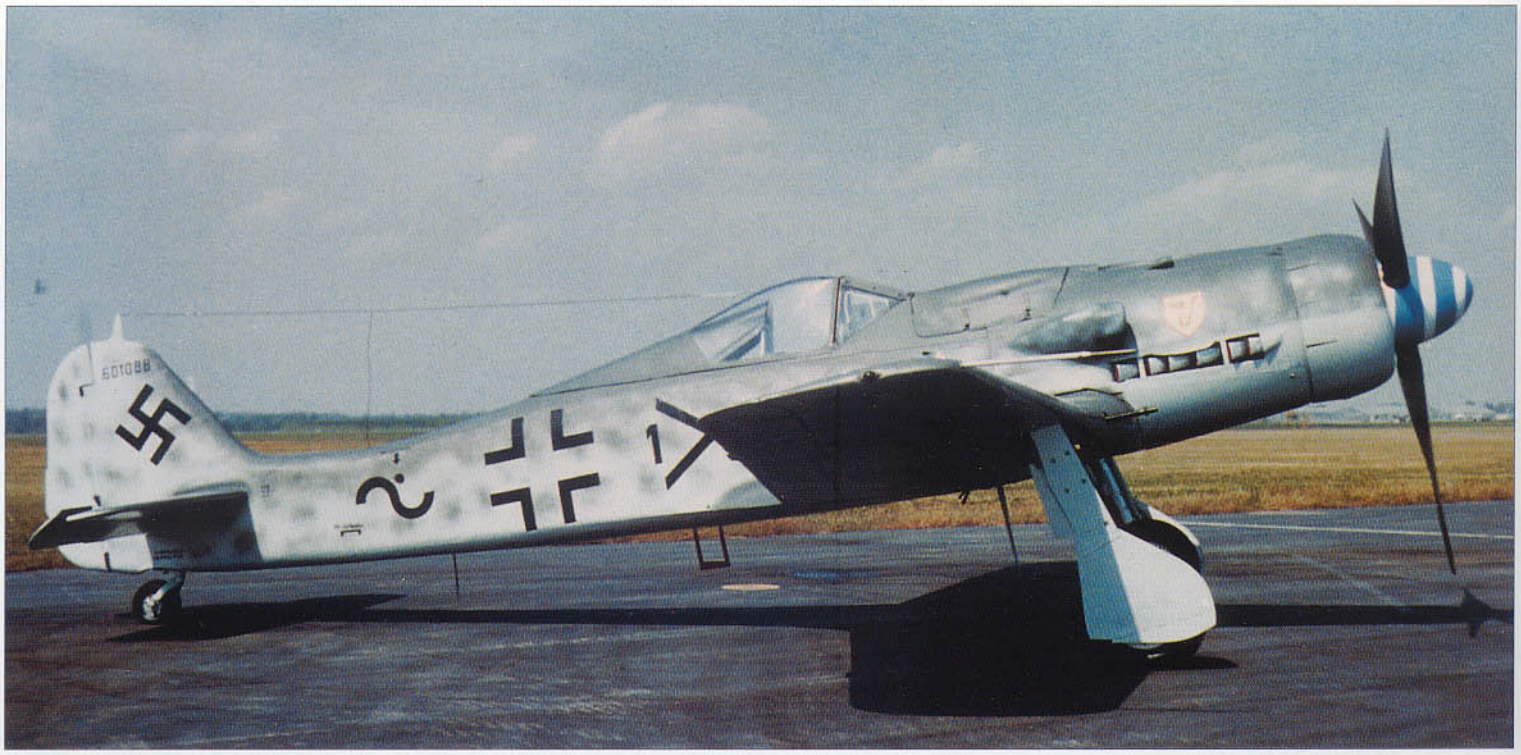




Above: Up to eight signal flares were carried along the lower port side of the fuselage. These were usually red or white recognition flares fired upon reaching a friendly airfield.

Below: Close-up of the fixed position homing direction finding antenna known as the *Peilrahmen* PR 16 which was mounted on the top of the rear fuselage.

Bottom: Two views of the port engine nacelle showing the spring-loaded foot grips for entry to the cockpit via the port wing.



Focke-Wulf Fw 190 D-9

The Fw 190 D-9 first appeared during late August, 1944, and was the result of a special Air Ministry requirement, presented jointly to Messerschmitt and Focke-Wulf, calling for a *Schnellösung* (quick solution) altitude fighter heavily based on existing production fighters. Prof. Kurt Tank and his able team of engineers evolved a number of design studies based on the highly successful Fw 190 A, but incorporating new engines, wings and other systems. Known as Ra-1 (*Rechnerische Ankündigung* - Analytical prospectus) through Ra-8, each was complimentary yet distinct. Three of these design studies explored features which were later adapted to the Fw 190 D. For instance, Fw 190 Ra-1 was to use the standard Fw 190 A wing, but with hydraulic undercarriage plus the new Junkers Jumo 213 engine. The Fw 190 Ra-4 introduced a new wing of 218.5 ft^2 (20.3 m^2) coupled with a hydraulic undercarriage and fitted with a Jumo 213. The Fw 190 Ra-8 design study featured the standard A-series wing, complete with electric undercarriage retraction, plus an extended rear fuselage and other features.

Two Fw 190 test aircraft were set aside to test the potential for the Ra-1 study: the Fw 190 V19 and V23. The Fw 190 V20, V21 and V25 were each dedicated to testing the Jumo 213. Initially, two production versions of the new D-series were planned: the non-pressurized Fw 190 D-1 and the pressurized Fw 190 D-2. The Fw 190 V22 and V23 were the designated test aircraft for the D-1, while the Fw 190 V26 and V27 were earmarked for the D-2. The Fw 190 V17 was selected to test features of the Ra-8 design study.

Near the end of 1943, Focke-Wulf instituted a number of changes, which not only affected its contender for the quick-solution altitude fighter, but also other Fw 190s. One of these changes called for the abandoning of the troublesome cabin pressurization system. Another change called for a new policy of parts standardization,which affected all production Fw 190s.

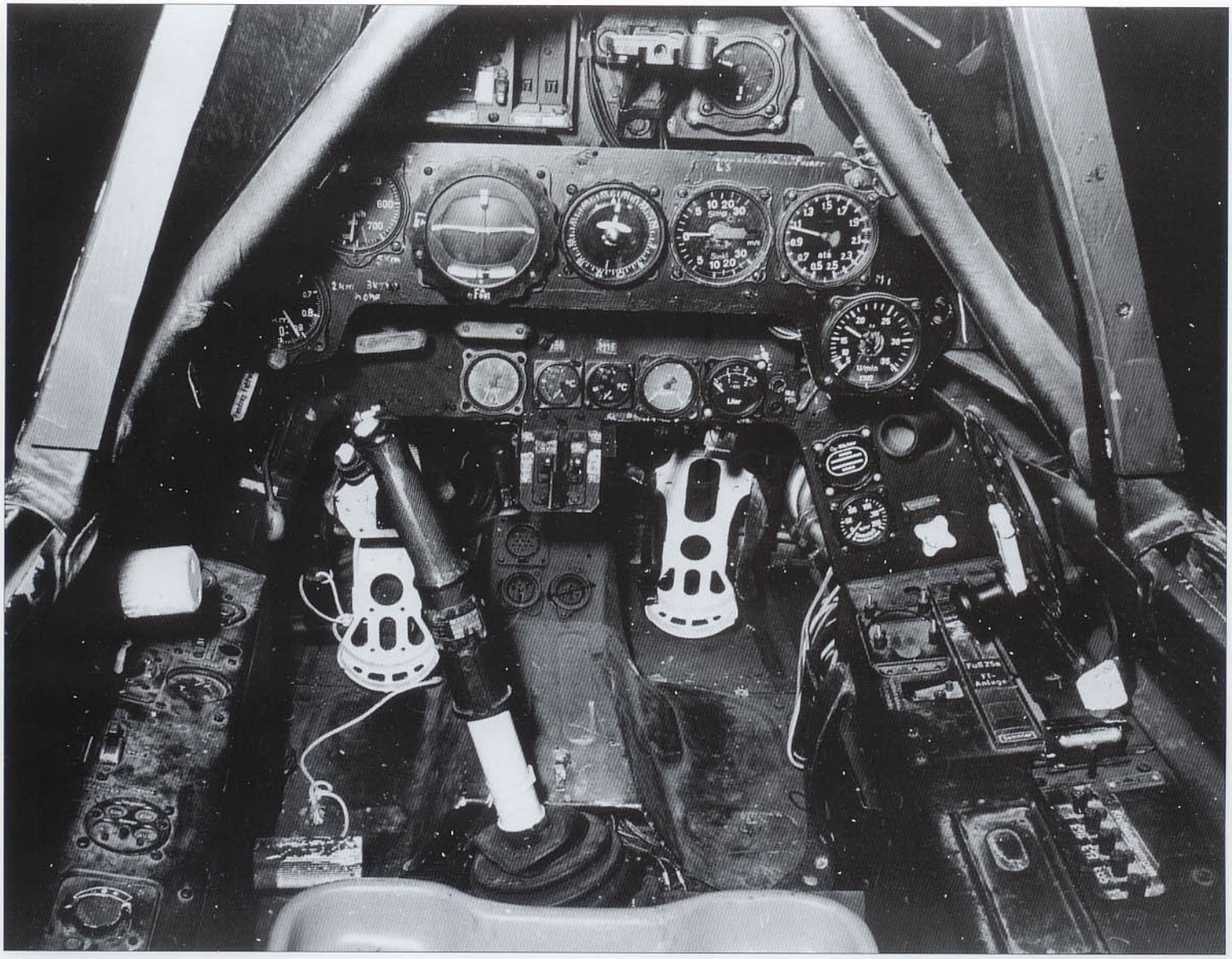
One of the results of this new policy was the decision to drop the planned Fw 190 D-1 and D-2 together with their four test aircraft. Instead, the first production version of the quick-solution altitude fighter was the Fw 190 D-9, because the airframe was so similar to that of the Fw 190 A-9.

Altogether, six Fw 190s were selected as D-9 research and development aircraft. These included the V17/U1, V53 and V54, plus the first three production machines manufactured at Cottbus (W.Nr. 210001, 210002, 210003).

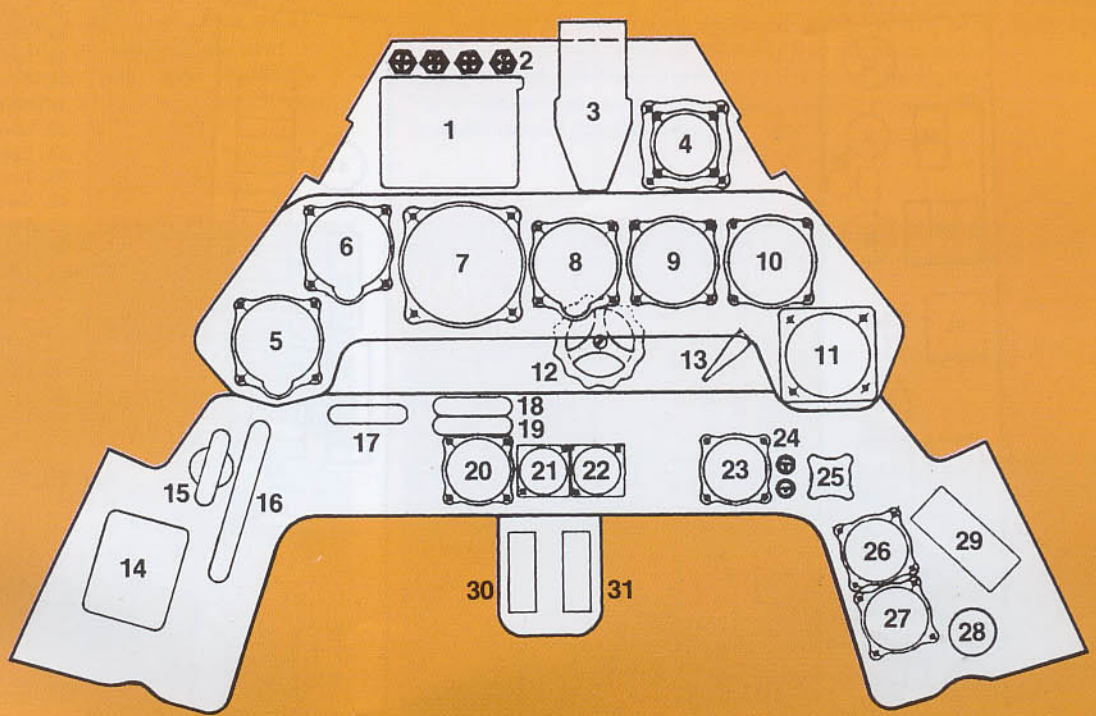
Production D-9s utilized airframes similar to the Fw 190 A-8/A-9 series, mated with the new Jumo 213 A-1 engine rated at 1,770 hp, and driving a Junkers VS 111 propeller. Delivery of the first D-9s began from the Focke-Wulf factories at Cottbus and Hannover/Langenhagen late in August, 1944. Shortly afterward, aircraft began leaving the Fieseler plant at Kassel-Waldau and the Arbeit-Gemeinshaft Roland facility. Not far into the production program, some aircraft were fitted with a low-pressure MW 50 water-methanol injection, which increased the take-off power to 2,100 hp. Aircraft so fitted carried fuel for the system in the rear 30 gal (115 ltr) tank and discarded the VS 111 prop for the VS 9.

Total production figures for the Fw 190 D are unknown, but at least 700 were completed before the end of the war, virtually all of these were Fw 190 D-9s.

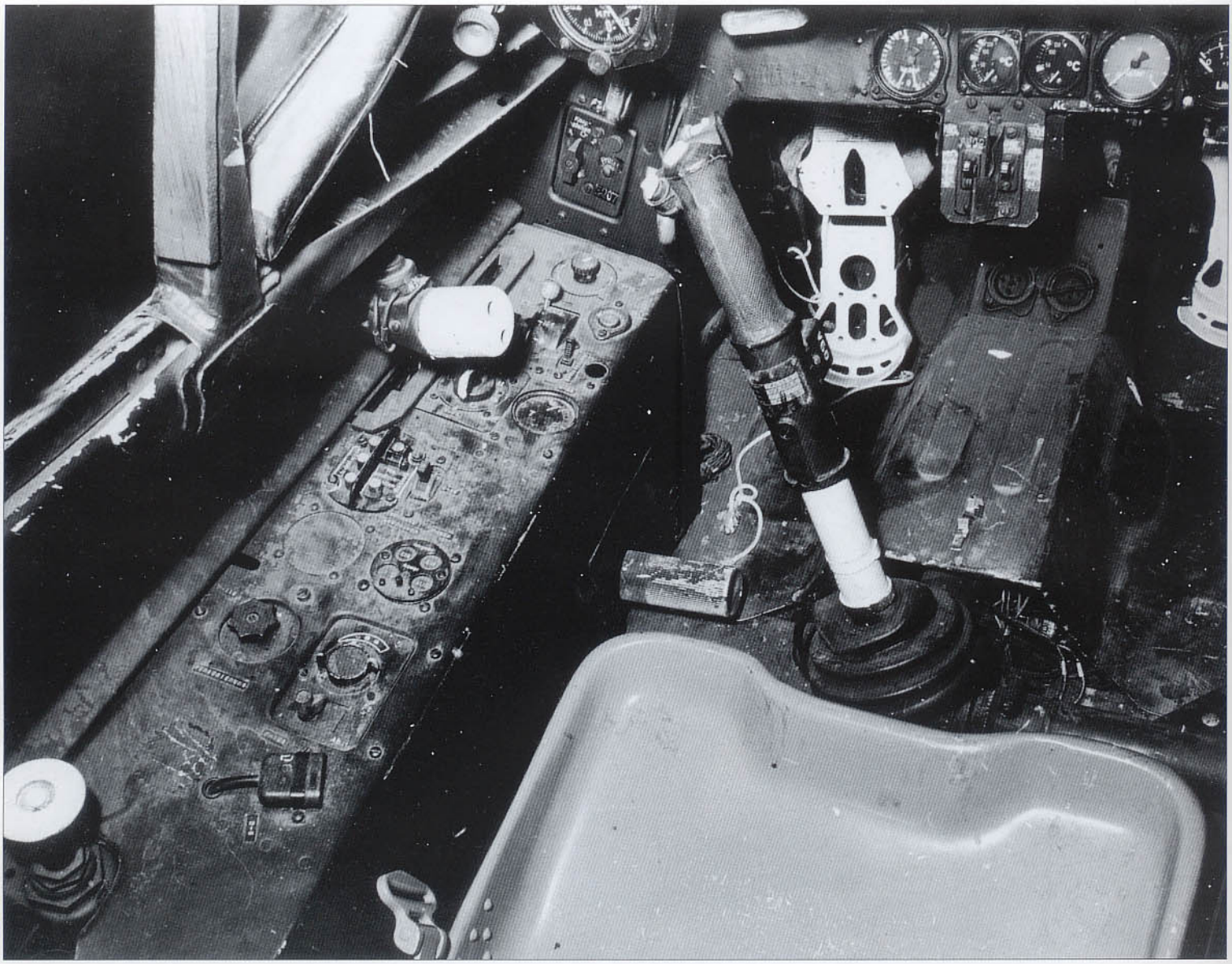
Above: Fw 190 D-9, W.Nr. 601088, of IV.(Sturm)/JG 3 "Udet" photographed after restoration at the USAF Museum, Wright-Patterson Air Force Base, Ohio. In spite of the fact this aircraft is fitted with a late production style canopy, many Dora-9s were assembled with the older non-bulged canopy.

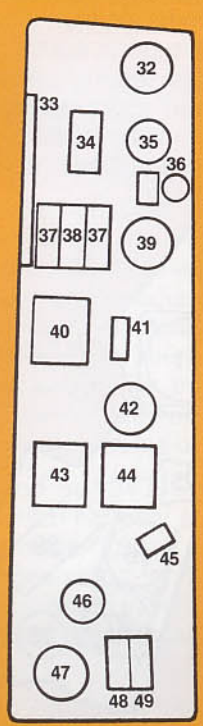


1. Ammunition round counters
2. Breech locking lamps
3. Revi gunsight
4. AFN 2 homing indicator
5. Altimeter
6. Airspeed indicator
7. Turn and bank indicator
8. Variometer
9. Repeater compass
10. Supercharger boost gauge
11. Tachometer
12. Manual engine coolant flap control
13. Cold start and window rinsing
14. FuG 25a IIF control unit
15. Maunal undercarriage lower handle
16. Fuel selector lever
17. Emergency pull for peak engine power
18. Emergency release for wing ordinance
19. Emergency release for fuselage load
20. Fuel + oil pressure gauge
21. Coolant temperature gauge
22. Oil temperature gauge
23. Fuel contents gauge
24. Low fuel warning lamp (top) in red, rear tank switchover (lower) in white
25. Fuel gauge selector switch
26. Oxygen flow indicator
27. Oxygen pressure gauge
28. Oxygen flow valve
29. Singlar flare pistol holder
30. Saftey switch
31. WGr 21 rocket launch switch (R6)

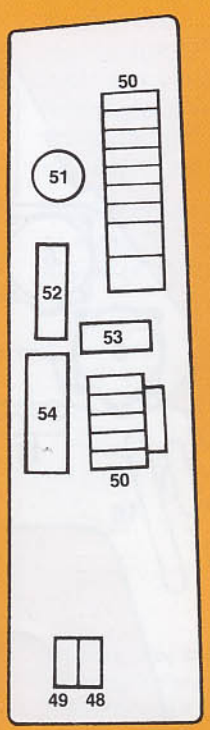


FW 190 D-9 Instrument Panel



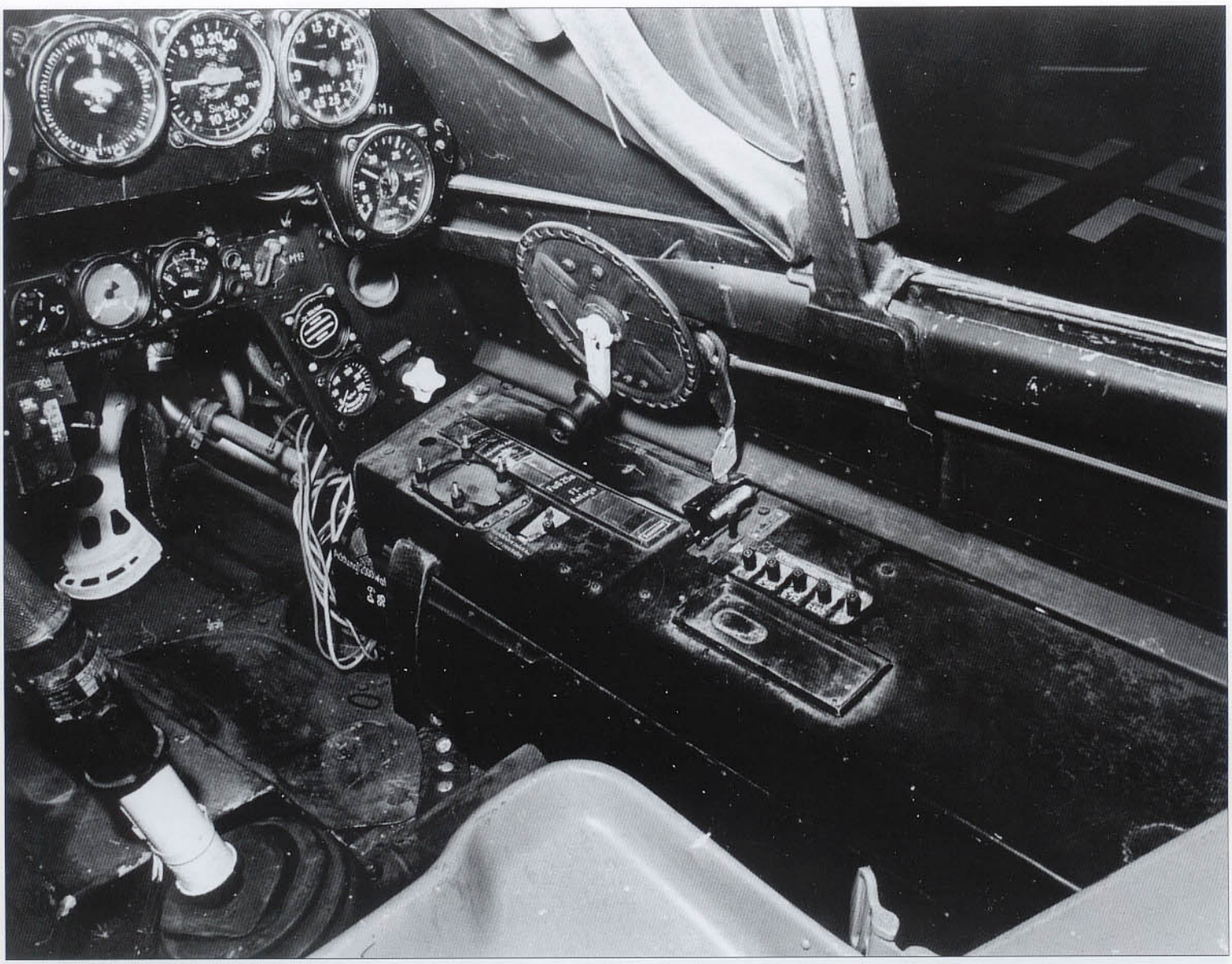


Left Console



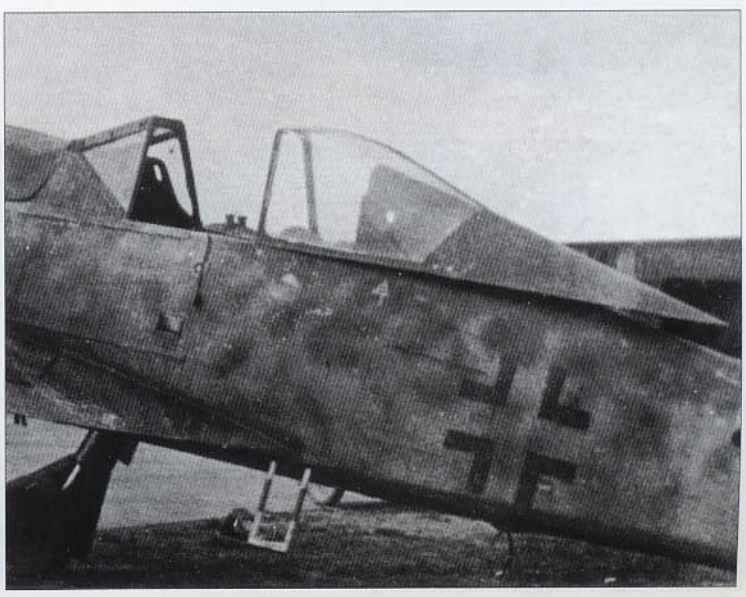
Right Console

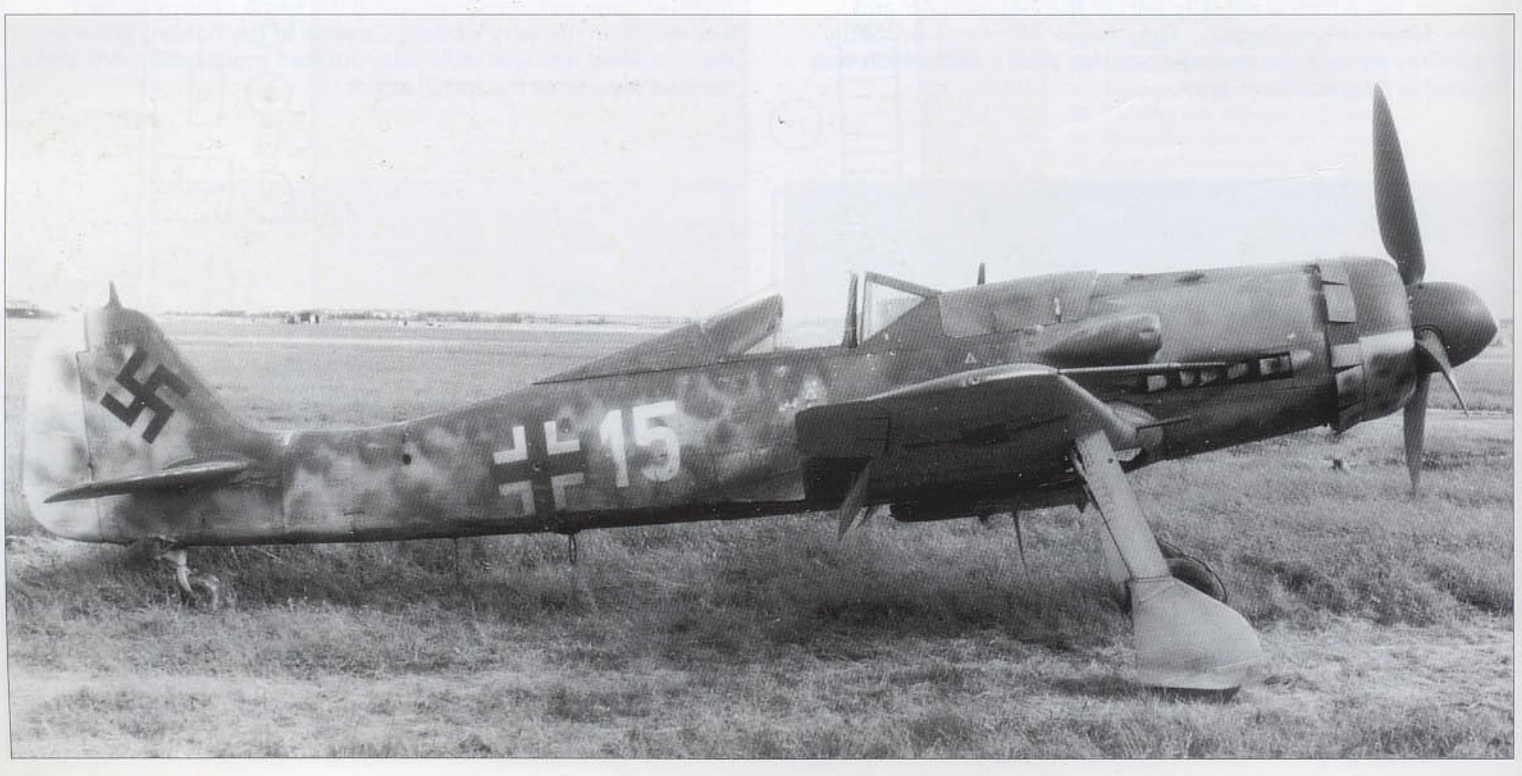
32. Panel dimmer switch
33. Throttle
34. Ignition switch
35. Emergency power switch
36. Special fuel supply switch (R5)
37. Undercarriage position indicator
38. Landing flap position indicator
39. Horizontal stabilizer trim indicator
40. Gear and landing flap switch
41. Horizontal stabilizer trim switch
42. FuG 16 ZY radio frequency selector
43. FuG 16 ZY fine tuning receiver
44. FuG 16 ZY volume control, communications and homing switch
45. Electrically heated flying suit connection
46. Fuel primer pump handle
47. Pilot's helmet radio connection
48. Ejection seat warning placard (if so fitted)
49. Identification placard
50. Curcuit breaker panel cover
51. Clock
52. Compass deviation card
53. Starter switch
54. Aircraft data card



Above opposite and above: Port and starboard views of the cockpit consoles belonging to the D-9 on display at the USAF Museum, but which is actually part of the National Air and Space Museum's collection. The interior color was primarily Black-Gray 66 with the exception of the pilot's seat which was finished in a light primer gray.

Below left and right: Just as the Fw 190 A-8 utilized two similar, but distinct canopies, so too did the Fw 190 D-9. The older style, shown left, was essentially the same canopy as had appeared on the very earliest variants of the fighter, whereas the so-called late war style incorporated more headroom and a revised layout for the head armor.

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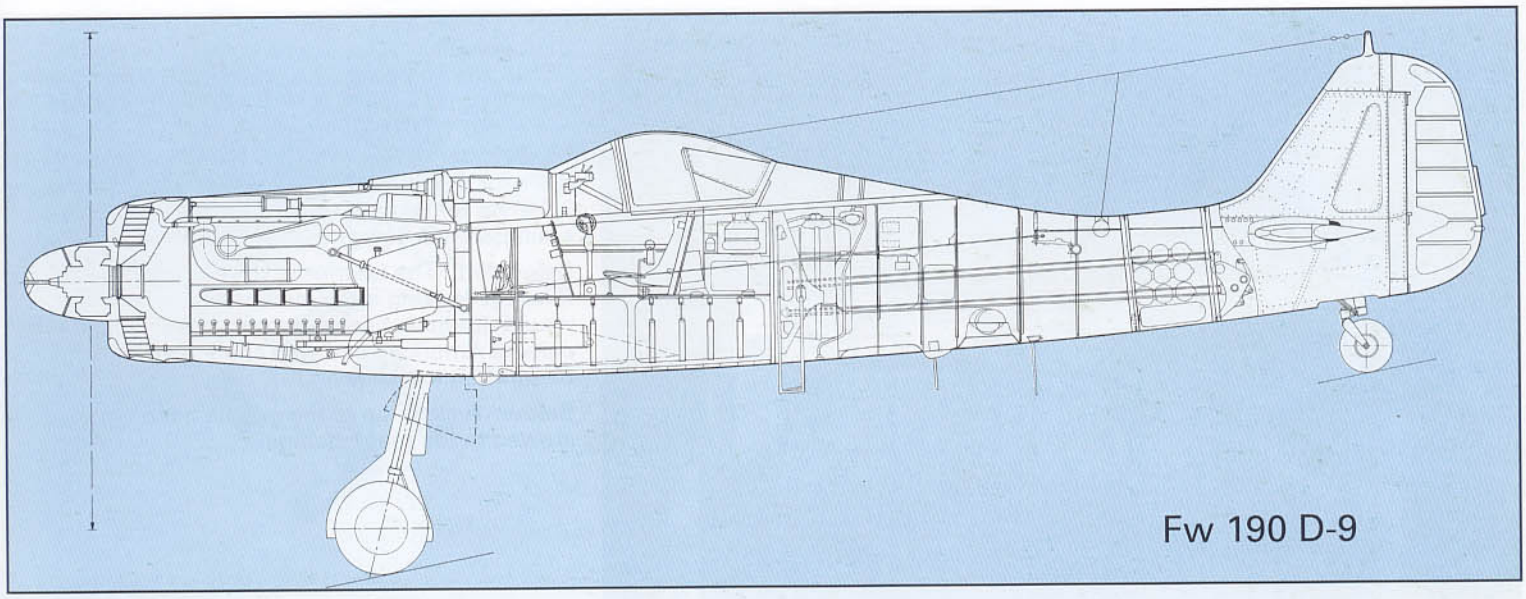
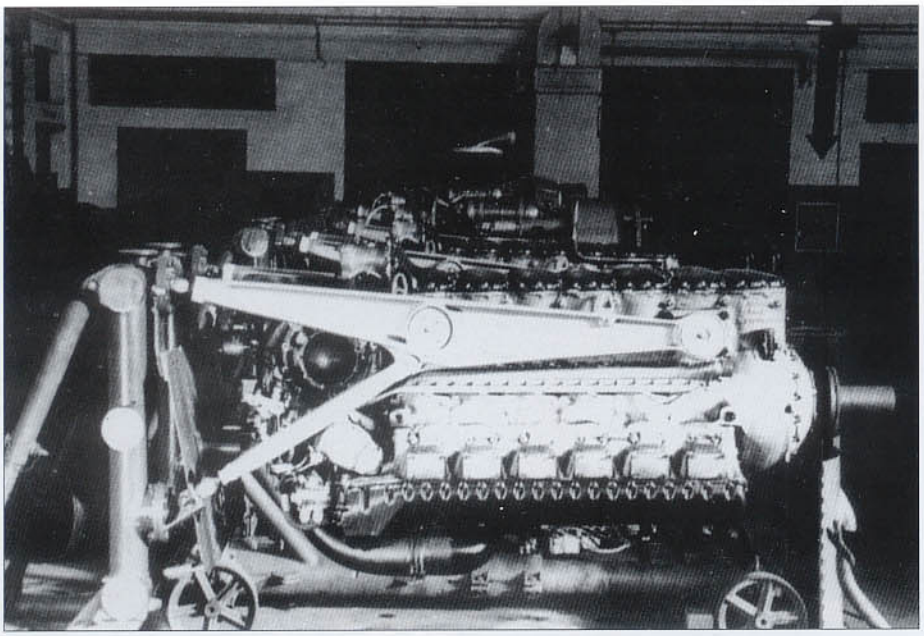


Left and below: Close-up of the rear fuselage access hatch fitted to the D-9 on display at the USAF Museum. The hatch cover on all early production machines was constructed of metal, whereas wood was later used in an effort to conserve aluminum. The pilot's ladder, shown extended beneath the chevron insignia, was fully retractable. To deploy the ladder from the ground, outside the cockpit, one had to lightly press a small button located near the top of the ladder's travel. It is interesting to note, that in an emergency, it was not unusual for a small sized male or female passenger to be squeezed into the rear fuselage. This practice occurred in more than one instance at the war's end, when the pilot and his passenger sought to surrender at an Allied-controlled airfield.

Opposite: It is possible that this Fw 190 D-9, W.Nr. 600651, white 15, was operated by I./JG 2 based at Merzhausen in December 1944. Note the under fuselage bomb rack which allowed the aircraft to operate in the ground-support role.

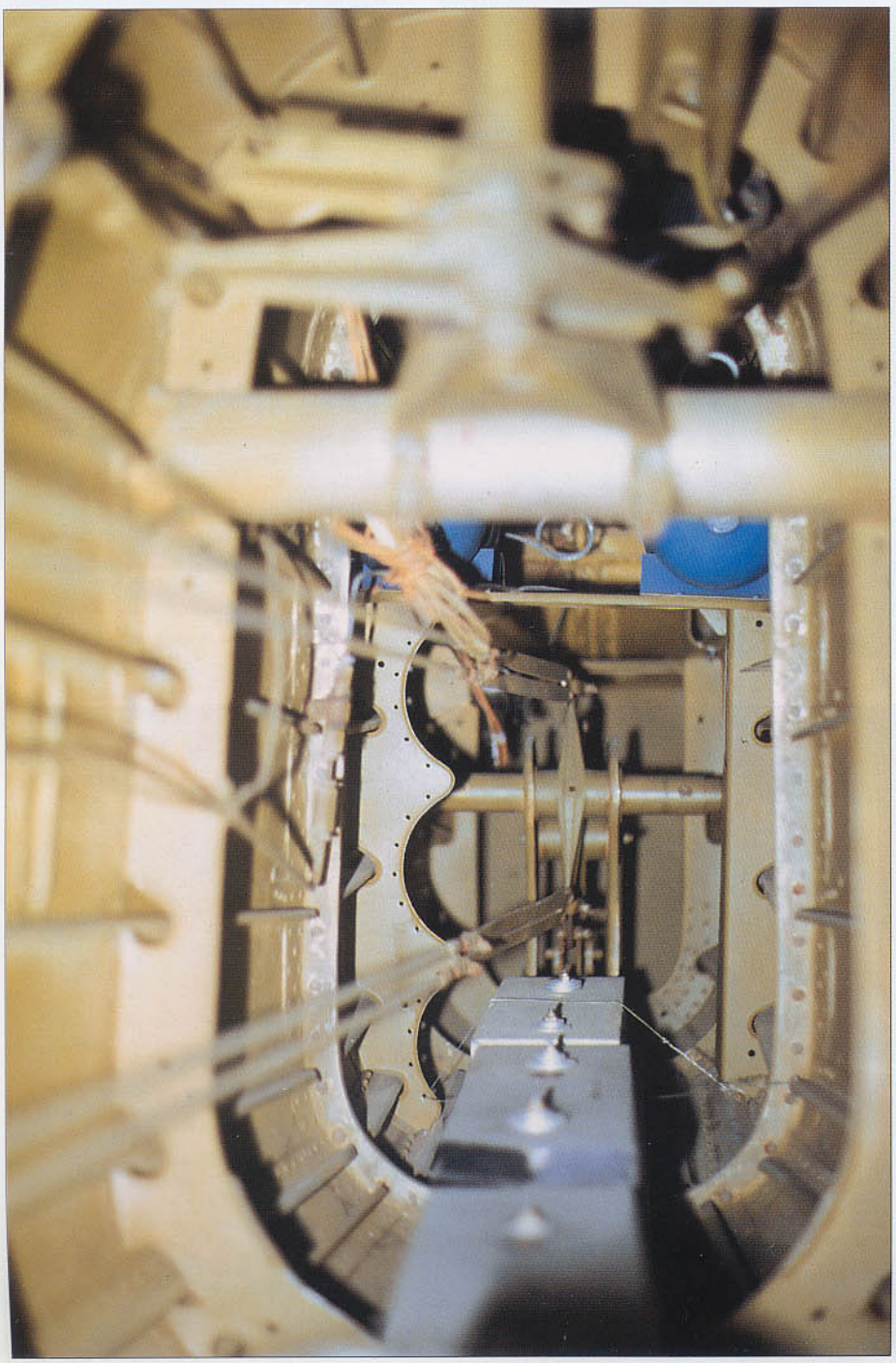
Opposite top: Overall view of the main instrumenl panel to the aircraft shown on page 170.

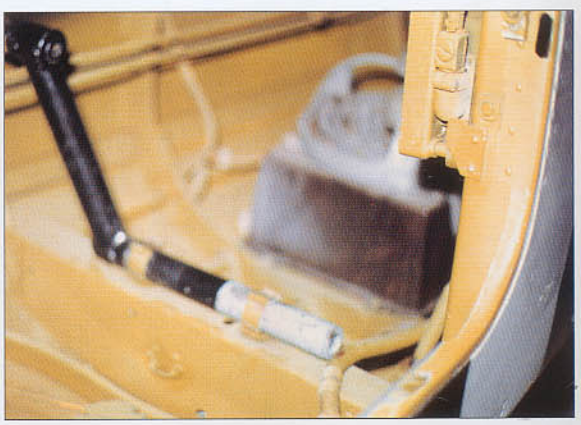


Left: The Junkers Jumo 213 A-1 was the standard powerplant for the Fw 190 D-9. It was a 35 litre (2,136 cu in) pressure-cooled V12 with a single stage, two-speed DVL supercharger which produced 1,770 hp for take off at 3,250 rpm using B4 (87 octane) fuel. The Fw 190 D-9 was also eligible for the Jumo 213 A-2 which developed 2,240 hp for take off using C3 fuel (96 octane) and equipped with low pressure MW powerboosting.

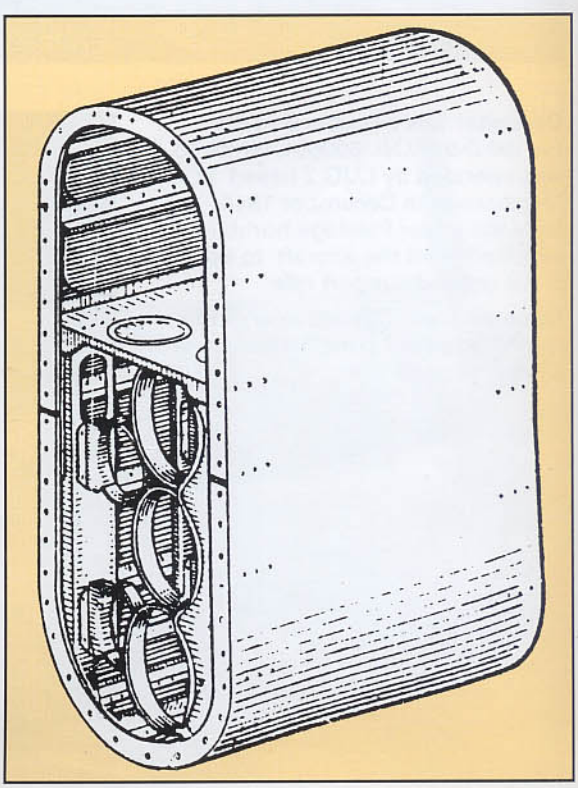
Below left: The interior of the Fw 190 D-9's rear fuselage looking aft. Traditionally, this area would not have been painted. The zinc-chromate color is American and was applied at the time restoration took place.

Below: A close-up of the engine hand crank stowed in the rear fuselage.



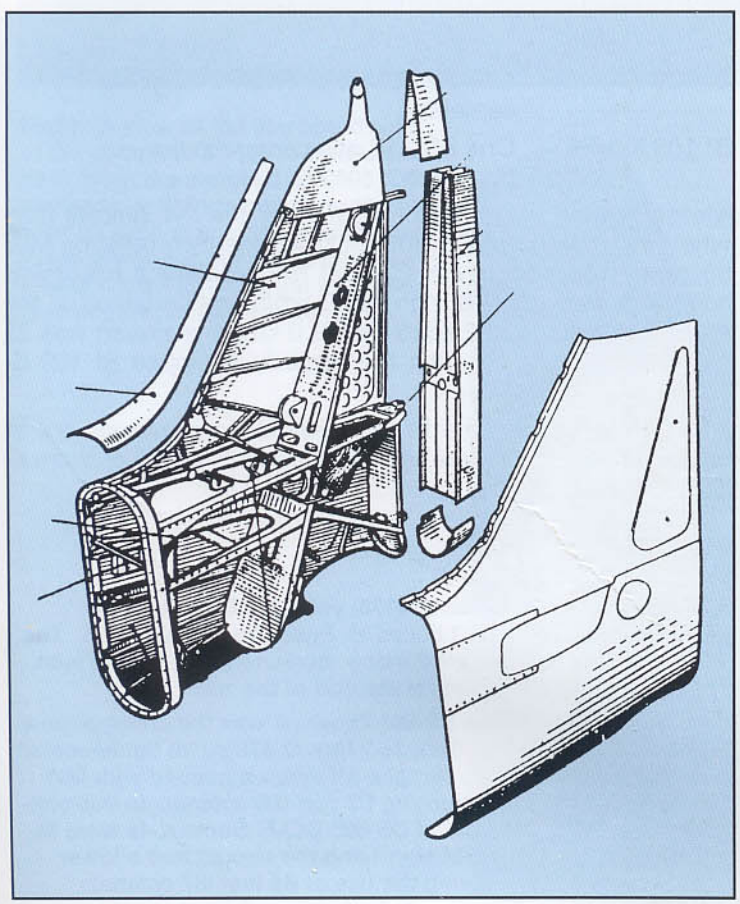


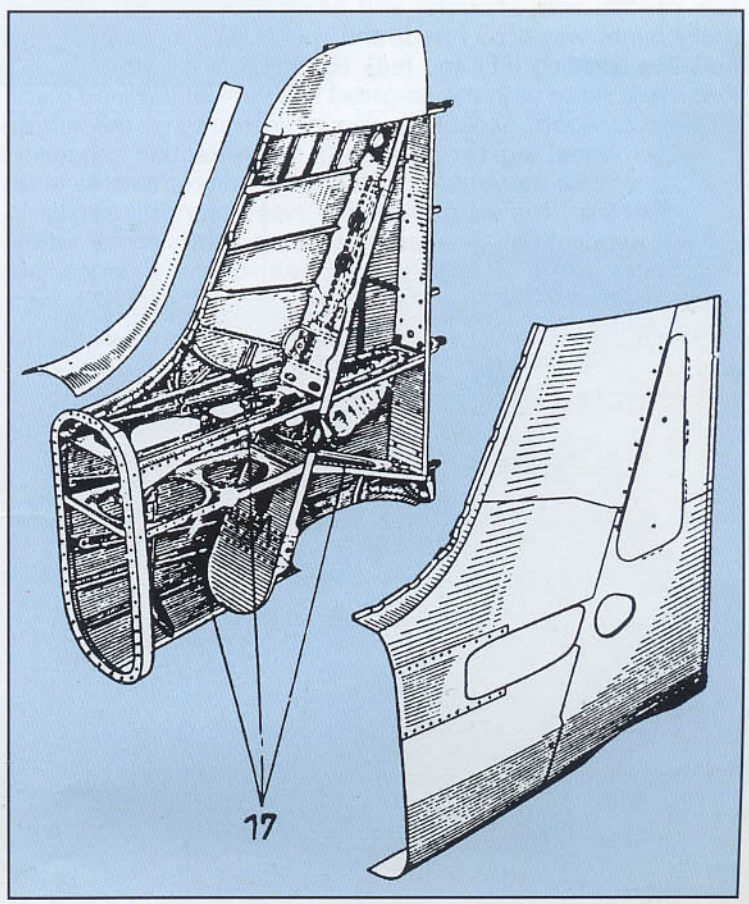
Below: An illustration of the 19.7 inch (500 mm) long parallel box section inserted in the rear fuselage in order to increase the overall length of the Fw 190 D-9.



Above and below: Apart from a narrow filler section (17 below), the all-metal tail assembly for the Fw 190 D-9 was identical to that used for all of the Fw 190 A-series. The photograph above is a close-up of the D-9 on display at the Air Force Museum at Wright-Field.

Above and below: During the last half of 1944, the German aviation industry made use of the woodworking shops throughout Germany to create numerous parts and whole assemblies from wood such as the optional wooden tail assembly shown above on Fw 190 D-9, W.Nr. 500645.





Messerschmitt Bf 109 K-4

Appearing early in October,1944, the Bf 109 K-4 was essentially a refinement of later versions of the older G-series of 109s. It standardized on the newly developed Daimler-Benz DB 605 D engine, developing 1,800 hp for take-off, and driving a metal, three-bladed VDM 9-12159 A propeller. Armament consisted of one 30 mm MK 108 engine-mounted cannon with 65 rounds, plus two 13 mm MG 131 cowl-mounted machine guns, each with 300 rounds.

All models of the K-4 series standardized on the one-piece Erla canopy with shoulder and head armor. A new instrument panel was also fitted, and most were equipped with FuG 25a (Erstling IFF) and FuG 16ZY radios. Additionally, all K-4s were fitted with the so-called tall, vertical tailplane made of metal or wood. Most K-4s also standardized on the lengthened tail wheel leg complete with full retraction capability, but a few were delivered with the older non-retractable short tail wheel leg. The wing of the K-4 was essentially similar to the late production G-series, apart from provision for wheel well doors...an item originally planned for the G-series, but never instituted.

The fuselage of the Bf 109 K-4 was essentially similar to the G-series, apart from the location of the access hatch positioned on the port side, and relocation of the fuel filler point and direction- finding loop.

The K-4 was eligible for a number of *Rüstsätze* (auxiliary apparatus) items, including:

Bf 109 K-4/R1 – One ETC 500/IXb or Schloss 503 bomb rack.

Bf 109 K-4/R2 – One Rb 50/30 reconnaissance camera.

Bf 109 K-4/R3 – One 300 litre under-fuselage drop tank.

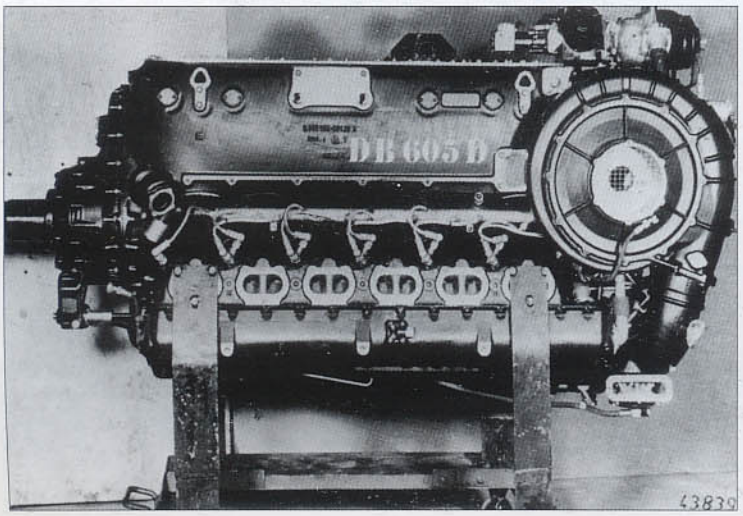
Bf 109 K-4/R4 – Two MG 151/20 under-wing cannons.

Bf 109 K-4/R5 – One Rb 32/7x9 or Two Rb 12.5/7x9 cameras.

Bf 109 K-4/R6 – One BSK 16 gun camera in the port wing.

Messerschmitt performance figures for the K-4 indicate that, when fitted with the DB 605 DCM engine incorporating MW 50 power boosting with C3 fuel (96 octane), a maximum combat speed of 416 mph (670 km/h) was attained at the maximum altitude of 29,515 feet (9.0 km), the aircraft was 23 mph (17 km/h) faster than the similarly equipped Bf 109 G-10/U4.

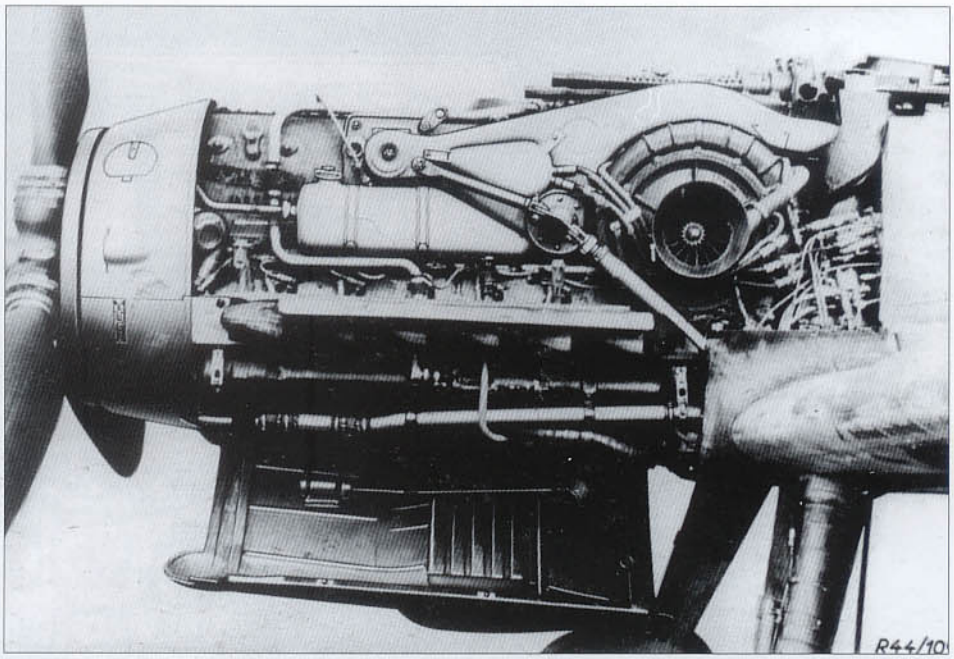
Total production for the Bf 109 K-series is unknown, but at least 750 examples were manufactured, almost all of them K-4s.

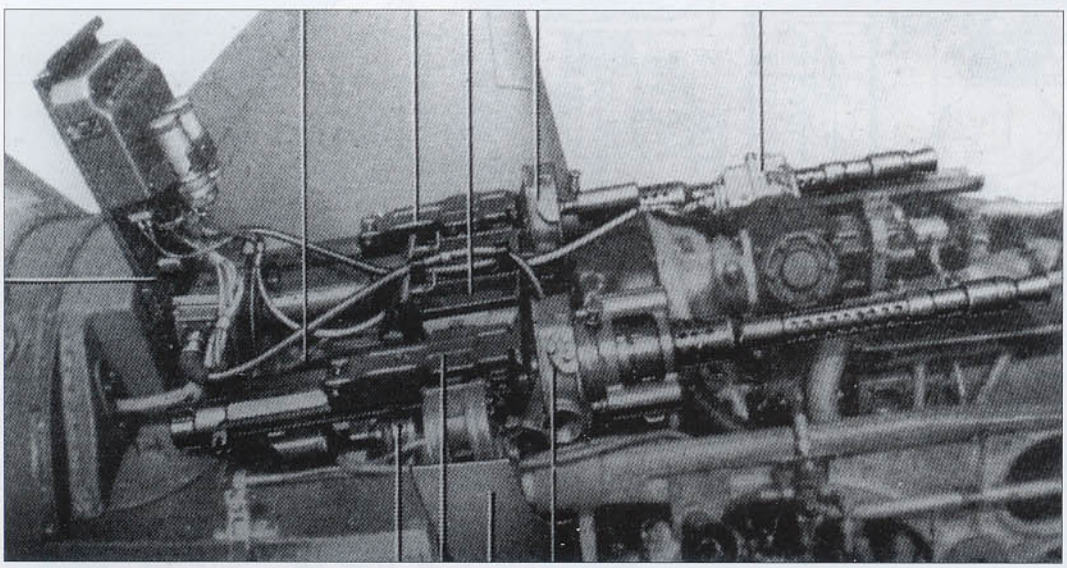


Above: Bf 109 K-4, W.Nr. 334176, yellow 7, flown by *Uffz.* Martin Deskau of II./JG 3 based at Pasewalk in April 1945. The K-4 series was the last production model to enter service with the German Air Force before the end of the war.

Left: A side view of the DB 605 D, which was the principal powerplant of the K-series. This 35.7 litre (2,178 cu in) liquid-cooled V12 developed 2,000 hp for take-off when equipped with MW 50 powerboosting and burning C3 fuel (96 octane). In this configuration it was designated DB 605 DCM. Some K-4s were fitted with the DB 605 DBM signifying the aircraft had a lower compression ratio allowing the use of B4 fuel (87 octane).

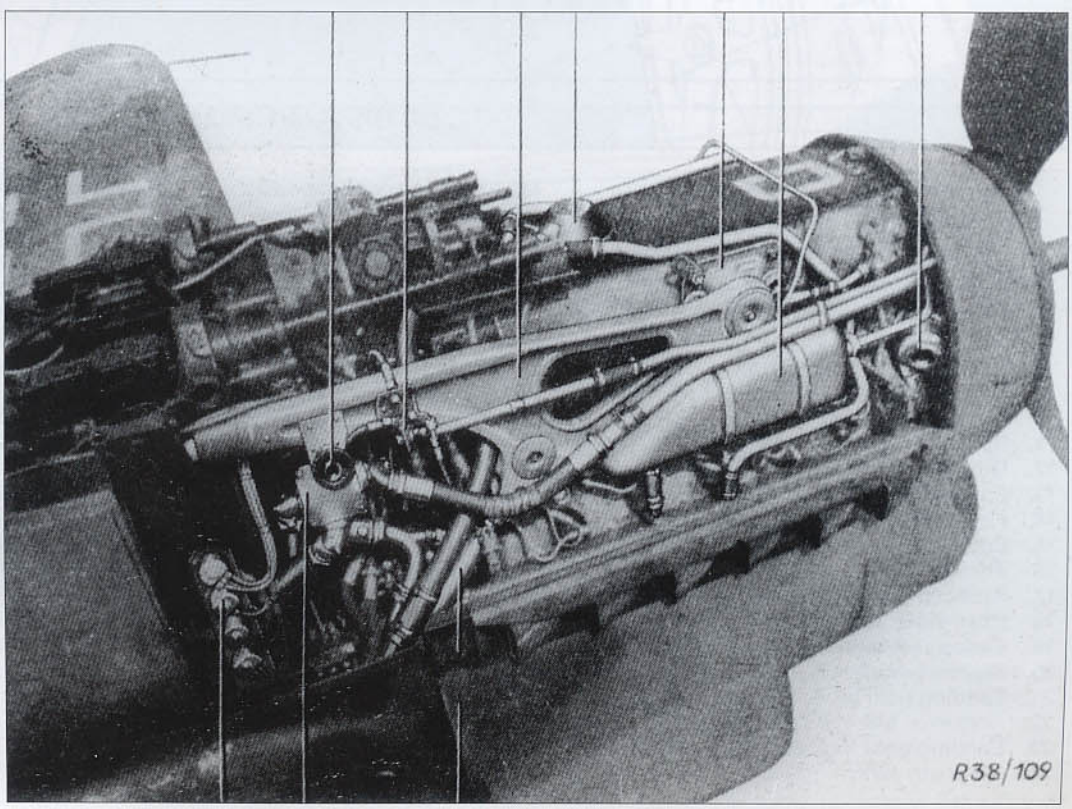
Right: Close-up of the port side of the Bf 109 K-4's engine compartment showing to advantage the enlarged supercharger and modified engine bearer arm supporting the DB 605 D engine. Since the Bf 109 K-4 and the Bf 109 G-10 were both powered by the DB 605 DCM engine, their respective engine bays were essentially identical. Thanks to its well engineered design, a team of well trained mechanics could perform a complete engine change in less than 30 minutes.

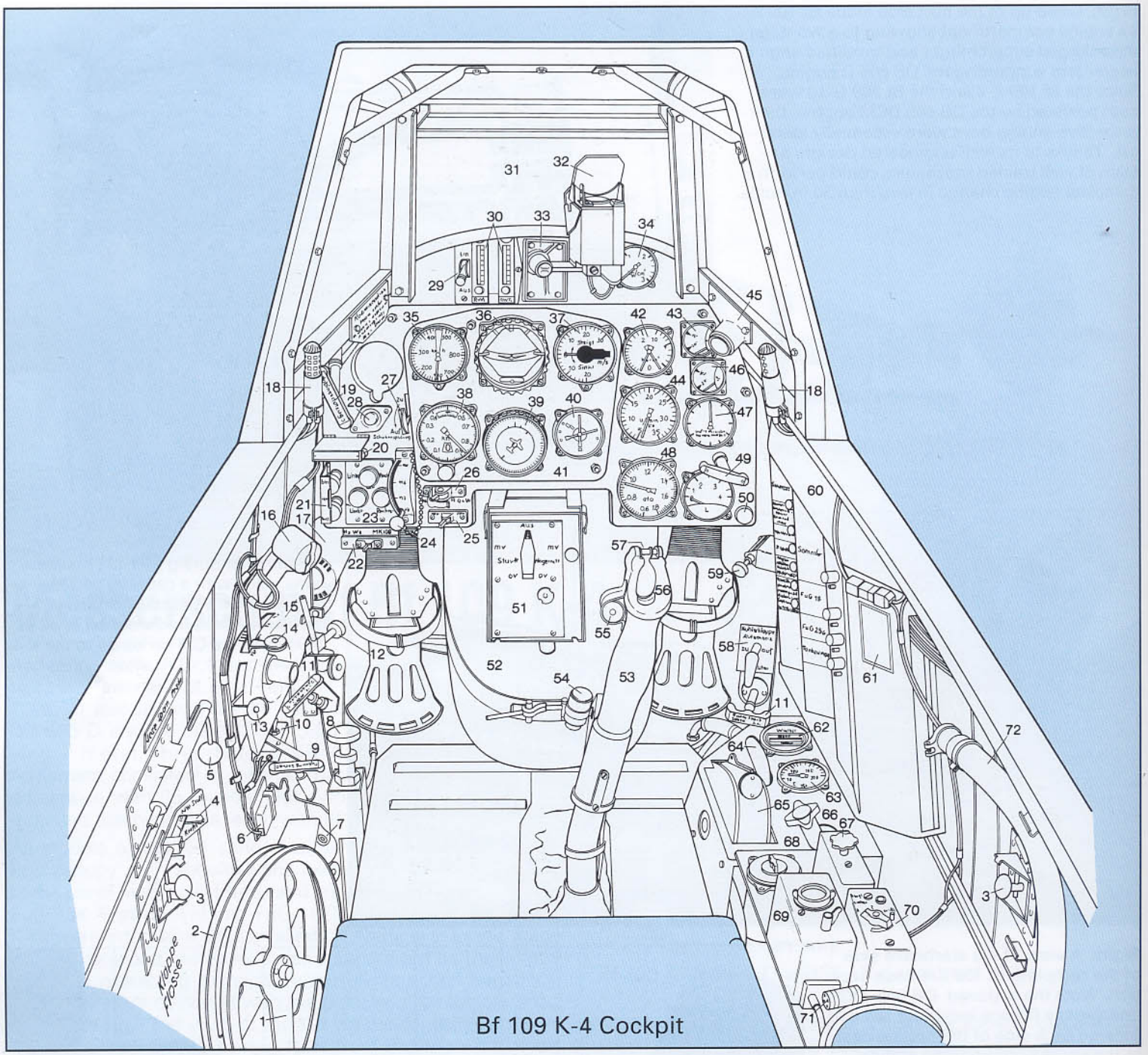




Left: Detail view of the Bf 109 K-4's upper cowl showing the two 13 mm Rheinmetall Borsig MG 131 machine guns, each with a capacity of 300 rounds. This weapon was the standard cowl- mounted weapon of all Bf 109s from the G-5 series up to the K-4.

Right: A view of the starboard side of the complete Bf 109 K-4 nose section. Note the exposed DB 605 DCM and various fittings including the two (one on each side of the engine next to the lower portion of the engine bearer arm) 7 litre (1.8 gal.) saddle-type engine coolant header tanks.





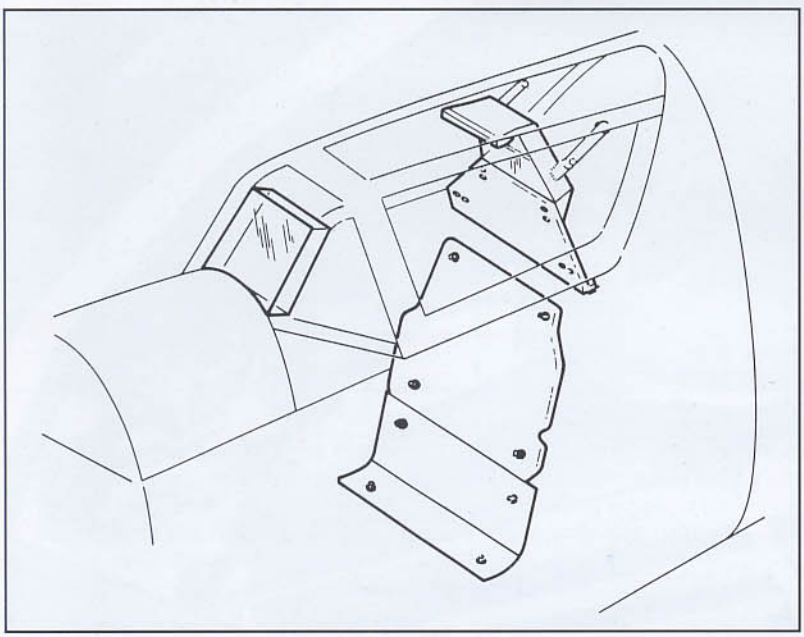
Bf 109 K-4 Cockpit

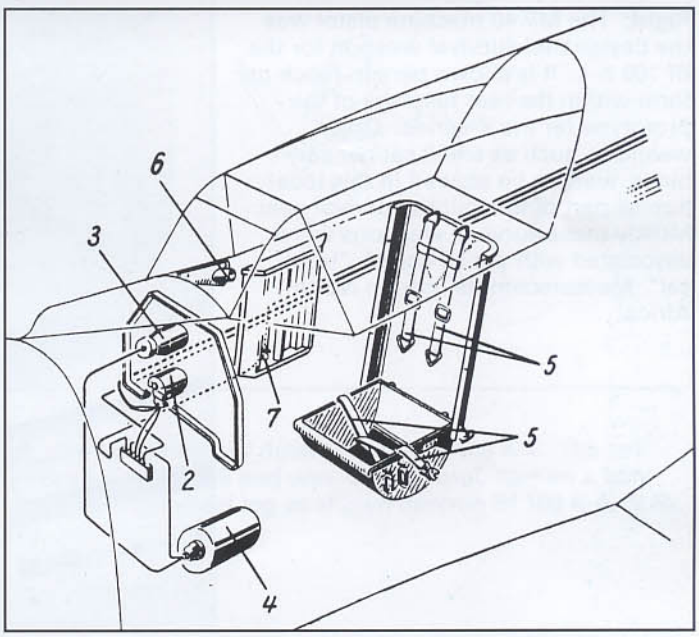
1. Trim wheel
2. Flap wheel
3. Cockpit vent
4. Shift lever-gauged fuel cocks
5. Tail wheel lock
6. Heated gloves plug
7. Trim indicator
8. Engine fuel priming pump
9. Drop tank release
10. Auto prop release
11. Radiator cut-out handle
12. Quick break switch
13. Engine quick stop handle
14. Fire safety level
15. Cold start pull
16. Throttle with thumb switch
17. Artificial horizon transformer
18. Ultra-violet light
19. Canopy jettison handle
20. Starter switch
21. Landing gear switches
22. Rocket or MK 108 selection
23. Landing gear indicators
24. Magneto switch
25. MW powerboost switch
26. Rocket launcher tube jettison*
27. Windscreen washer
28. Battery cut-off switch
29. Fire extinguisher
30. MK 108 ammo counter lights
31. Armored windscreen
32. Revi 16 B gunsight
33. Gunsight mount
34. MW boost pressure gauge
35. Airspeed indicator
36. Artificial horizon + turn and bank
37. Variometer
38. Fine and coarse altimeter
39. Repeater compass
40. AFN 2 homing device
41. IFR flight panel
42. Oil + fuel pressure gauge
43. Coolant temperature gauge
44. Tachometer
45. Signal flare pistol holder
46. Oil temperature gauge
47. Prop pitch indicator
48. Manifold pressure gauge
49. Emergency landing gear relase
50. Low fuel warning lamp
51. Auxiliary panel + fuses
52. MK 108 cannon breech cover
53. Control column grip
54. MK 108 electric arming button
55. Bomb release
56. MK 108 trigger
57. MG 131 trigger
58. Radiator flap lever
59. Quick release pull
60. Circuit breakers
61. Compass deviation card
62. Oxygen control
63. Oxygen pressure gauge
64. Drop tank transfer
65. Breathing oxygen
66. Oxygen cut-off switch
67. Remote radio FuG 16 ZY
68. FuG 16 ZY frequency selector
69. Pilots earphone plug
70. FuG 25 IFF control
71. Pilotís earphone connector
72. Oxygen house

* Not fitted to production aircraft

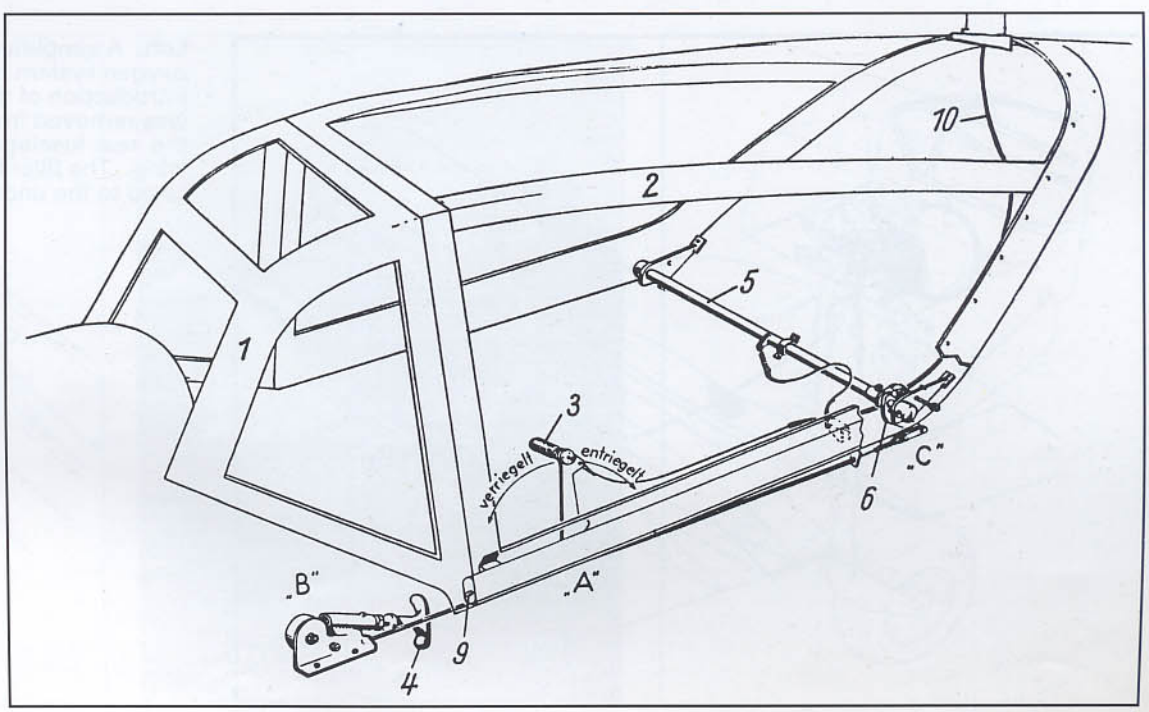
Right: Some idea of the size of the Bf 109's cockpit can be gained in this photograph of *Fw.* Strebel of II./JG 3 next to his Bf 109 K-4, yellow 4. Note the name Ingeborg painted below the cockpit and the yellow and white fuel triangle with the C3 rating clearly indicated.

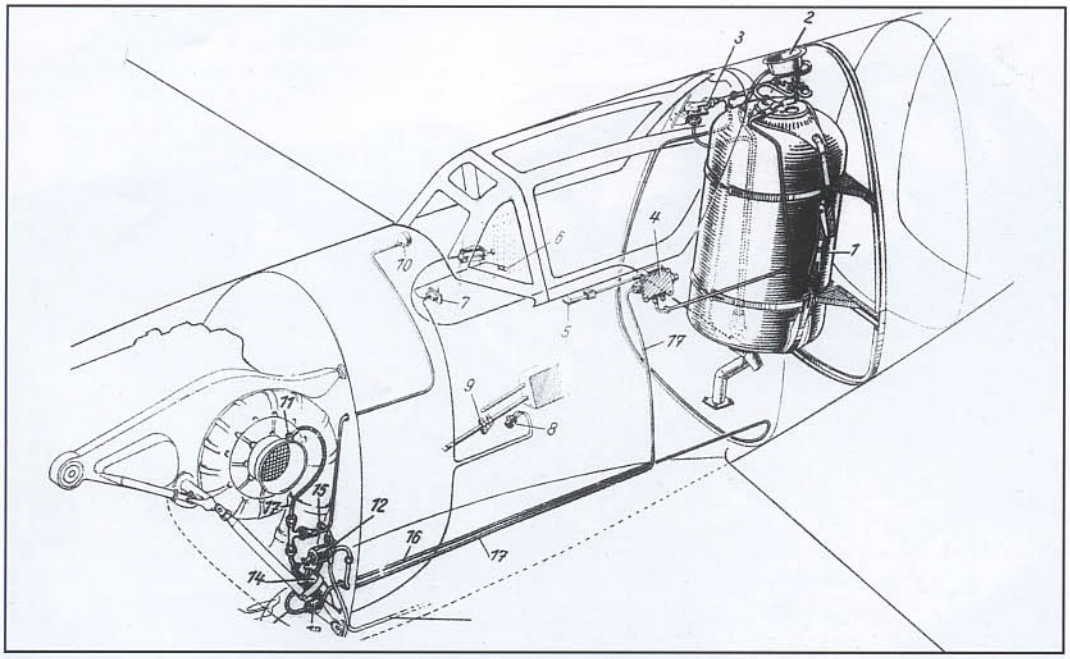
Below: Two views of the cockpit area showing the three-piece seat armor plus the two-piece shoulder and head armor attached to the canopy.





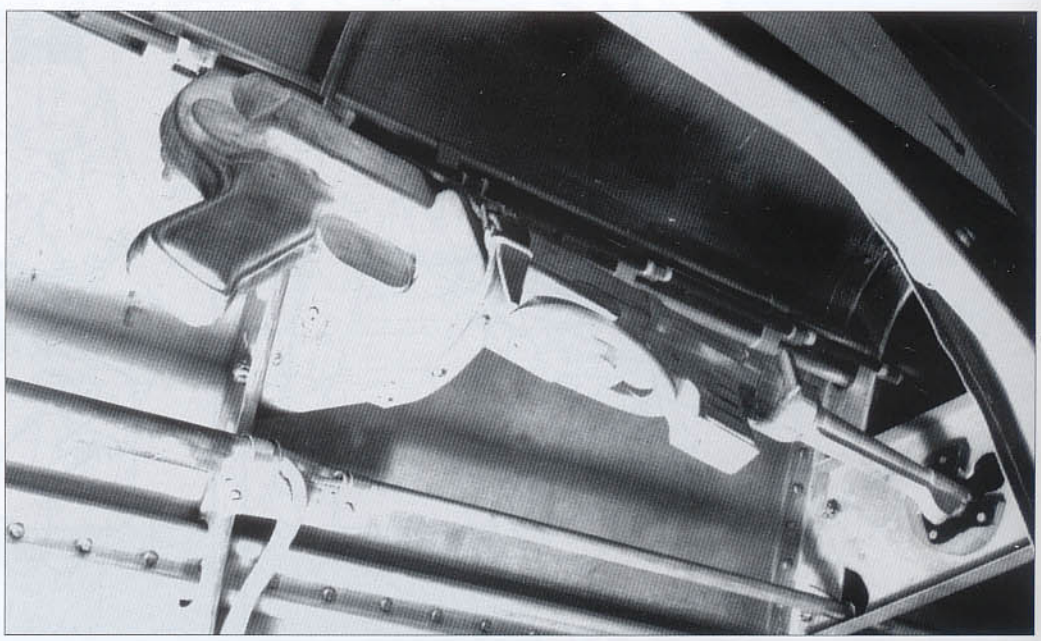
Right: A simplified sketch of the Bf 109 K-4 canopy and its locking handle (3) together with the emergency canopy jettison handle and cable (B). Designed by the Erla company as simplified one- piece canopy, it was also made available other versions of the Bf 109 including the G-5 through G- 14 series. Aircraft fitted with this canopy did not have any special change in their designation.

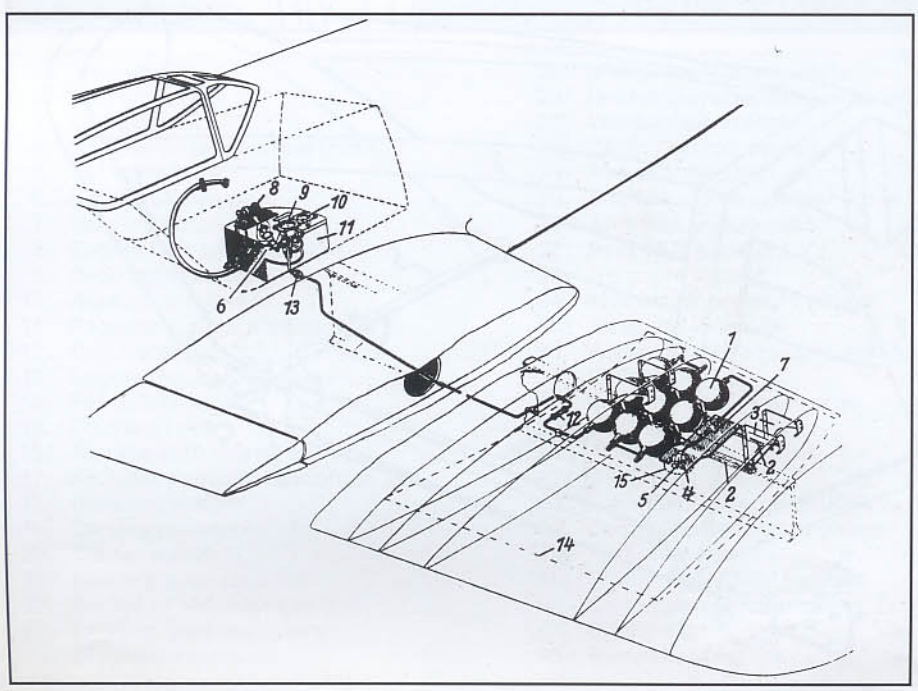




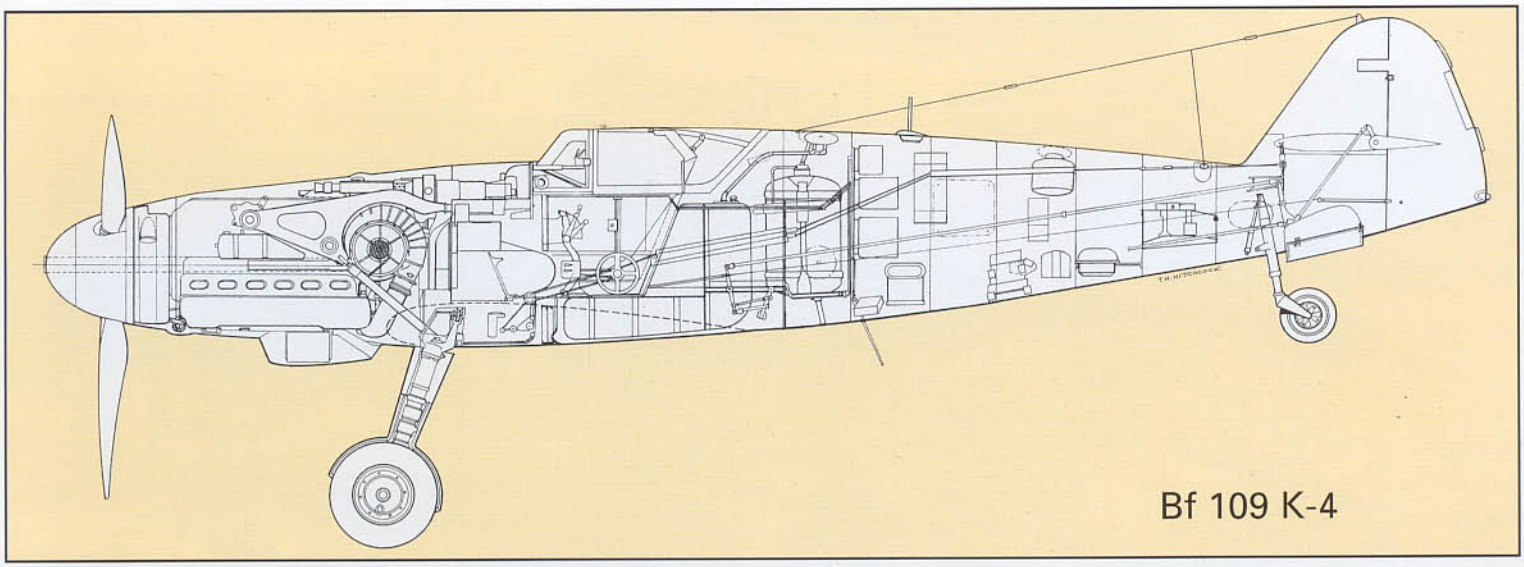
Left: The aft fuselage fuel tank of the Bf 109 K-4 was designed to hold either 29 gal (110 litre) of aviation fuel (B4 of 87 octane), or almost 20 gal (75 litre) of MW 50 for aircraft fitted with the necessary special injectors for this form of powerboosting. This tank supplemented the normal L-shaped 105 gal (400 litre) main fuselage tank plus the optional drop tank carrying 79 gal (300 litre) of aviation fuel.

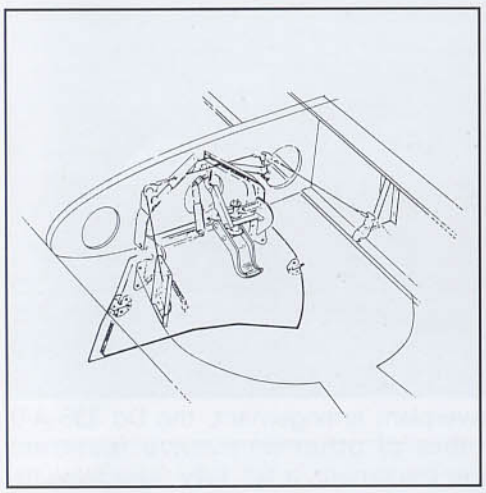
Right: The MP 40 machine pistol was the designated survival weapon for the Bf 109 K-4. It is shown here in mock-up form within the rear fuselage of the prototype for the K-series. Other weapons, such as small caliber carbines, were to be stowed in this location as part of the pilot's survival gear. Mostly these survival weapons were associated with the so-called "tropical" Messerschmitts used in North Africa.

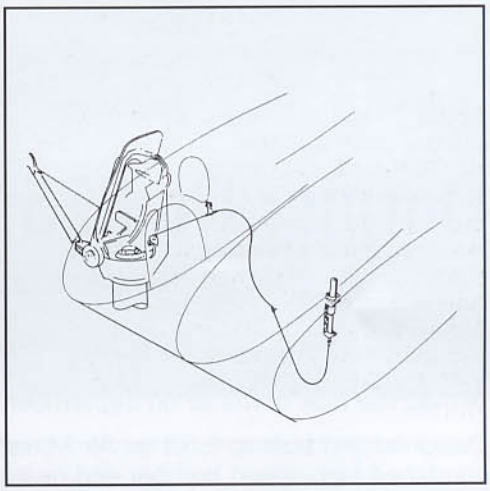




Left: A simplified sketch of the location of the oxygen system for the Bf 109 K-4. With the introduction of the K-series, the oxygen system was removed from its previous location within the rear fuselage, to a point inside the starboard wing. The filler hatch was correspondingly relocated to the under surface of the wing (15).

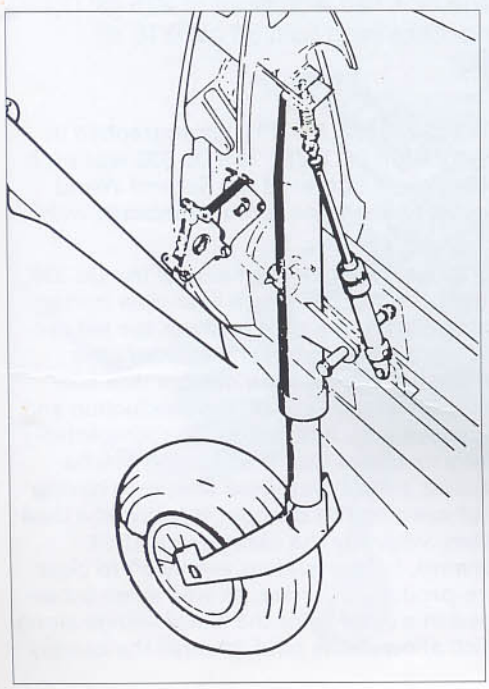


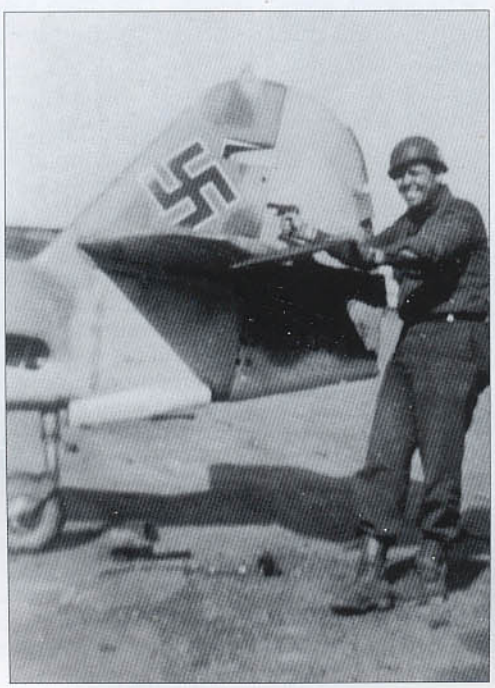


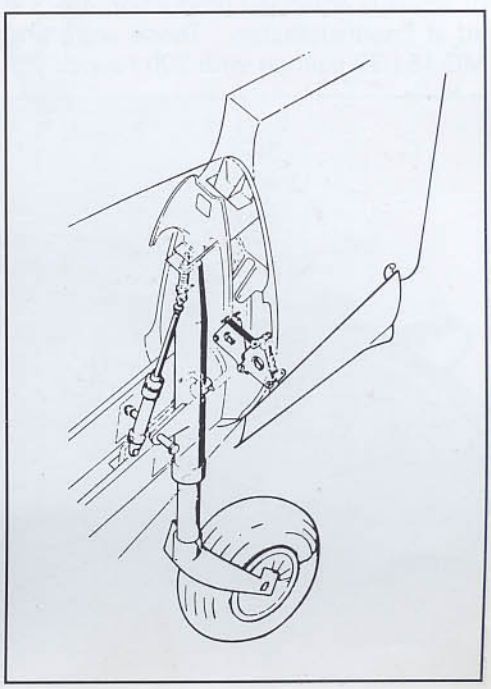


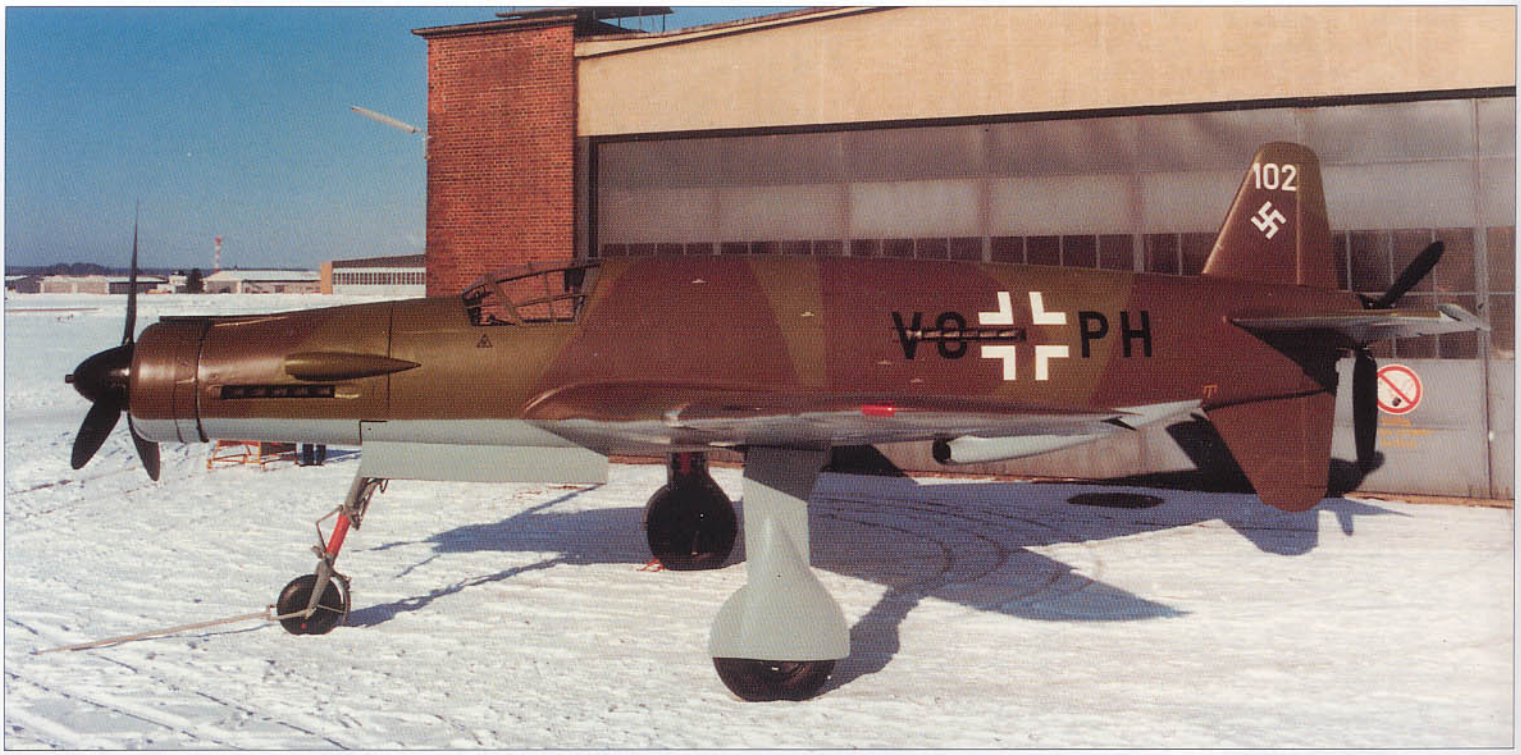
Above: Landing gear details of the Bf 109 K-4 showing the wheel well doors, main wheel (size 660x190) and the main gear retraction indicator located in the port wing's leading edge. The K- series were the first Bf 109s to use this means of determining if the main gear was retracted.

Below: Tail and tailwheel details for the Bf 109 K-4. The tail wheel size was 350x135 and was usually mounted on a fully retractable tall tailwheel leg as shown here on Bf 109 K-4, W.Nr. 335170.









Dornier Do 335 A-0

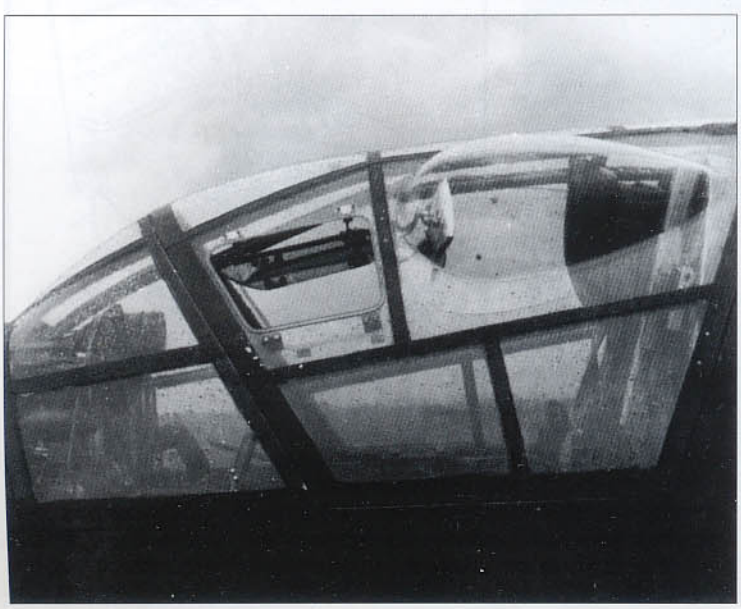
The first example of the unusual Do 335 to fly was the Do 335 V1, which took off from Dornier's airfield at Friedrichshafen on October 26, 1943. However, it was almost another year before the first preproduction series (A-0) machine took to the air on September 30, 1944.

Designed and built to fulfill an Air Ministry requirement for a combined high-speed bomber and heavy fighter with a secondary reconnaissance capability, the type was also produced to fulfill training and night-fighter demands.

Powered by a Daimler Benz DB 603 A-2 in front, with a similar DB 603 QA-2 in the aft bay driving a pusher propeller via a long hollow extension shaft, the Do 335 A-0 was capable of reaching 477 mph at 21,000 feet (763 km/h at 6.4 km).

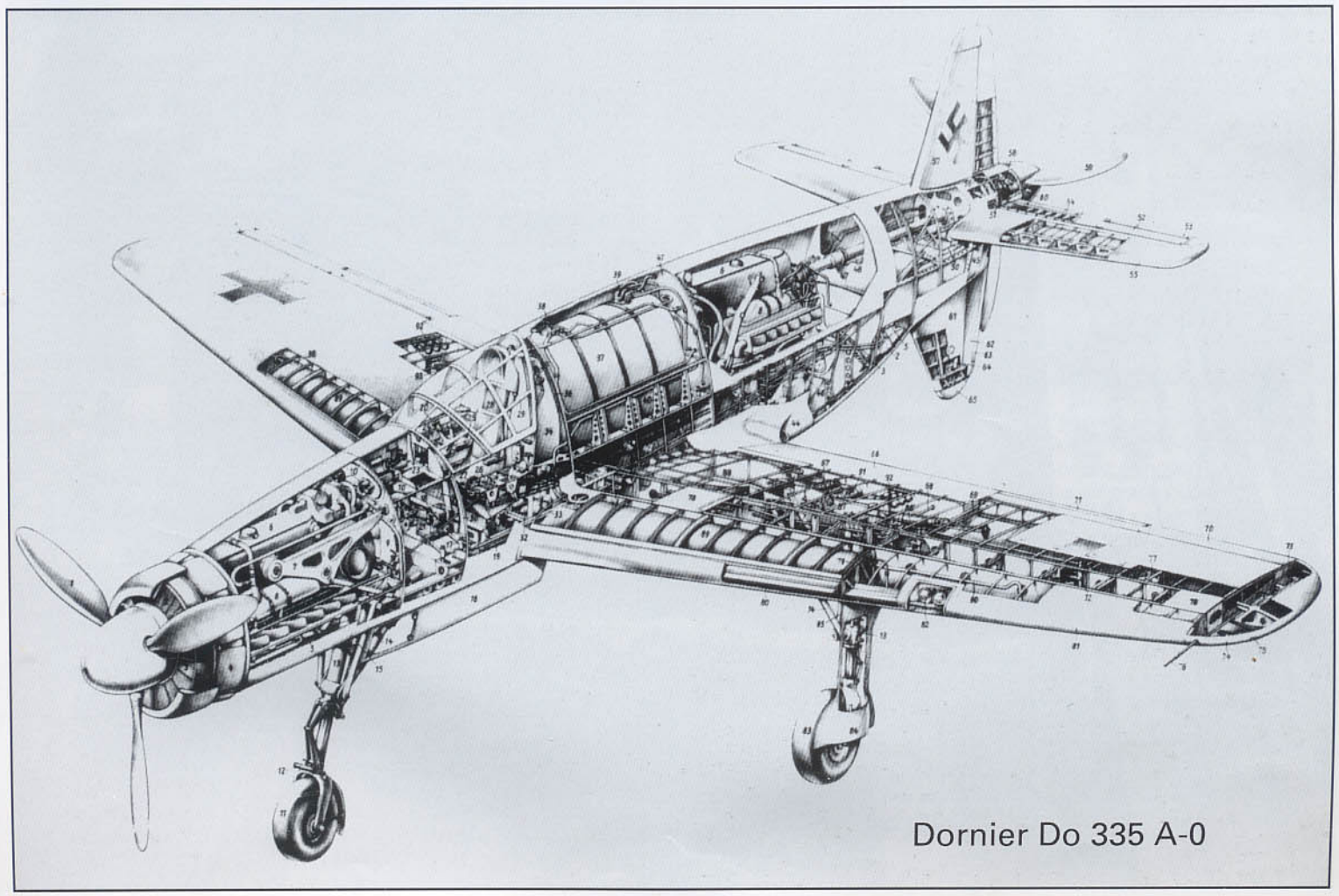
Ten preproduction aircraft were manufactured (A-01 to A010) at Dornier's Oberpfaffenhofen facility prior to a small number of similarly equipped production Do 335 A-1s being completed at Friedrichshafen. These were armed with two 20 mm MG 151/20 cannon with 200 rounds per gun above the cowl, augmented by a 30 mm engine-mounted MK 103 with 70 rounds. Initially, it was planned to have the firm of Luther u. Jordan at Brunswick involved in series production of the Do 335 A-1, but this plan was never implemented.

Besides the novel powerplant arrangement, the Do 335 A-0 also featured a number of other innovative features. Because of the propeller placement, a tall, fully retractable tricycle undercarriage was adopted. To protect the rear prop from contacting the ground, and to aid in stability, a cruciform-design tail was incorporated with a sprung tail bumper attached to the lower section. In the event of a forced wheels up landing, the pilot activated a cartridge explosive, which blew the entire lower tailplane and rear propeller clear of the airframe. In case it became necessary to bail out, the pilot was provided with an ejection seat. Three fuel tanks held a total of 503 gal (1,850 ltr) of B4 (87 octane) aviation fuel. The main fuselage tank had a capacity of 325 gal (1,230 ltr), while the two wing-tanks each held 89 gal (310 ltr).

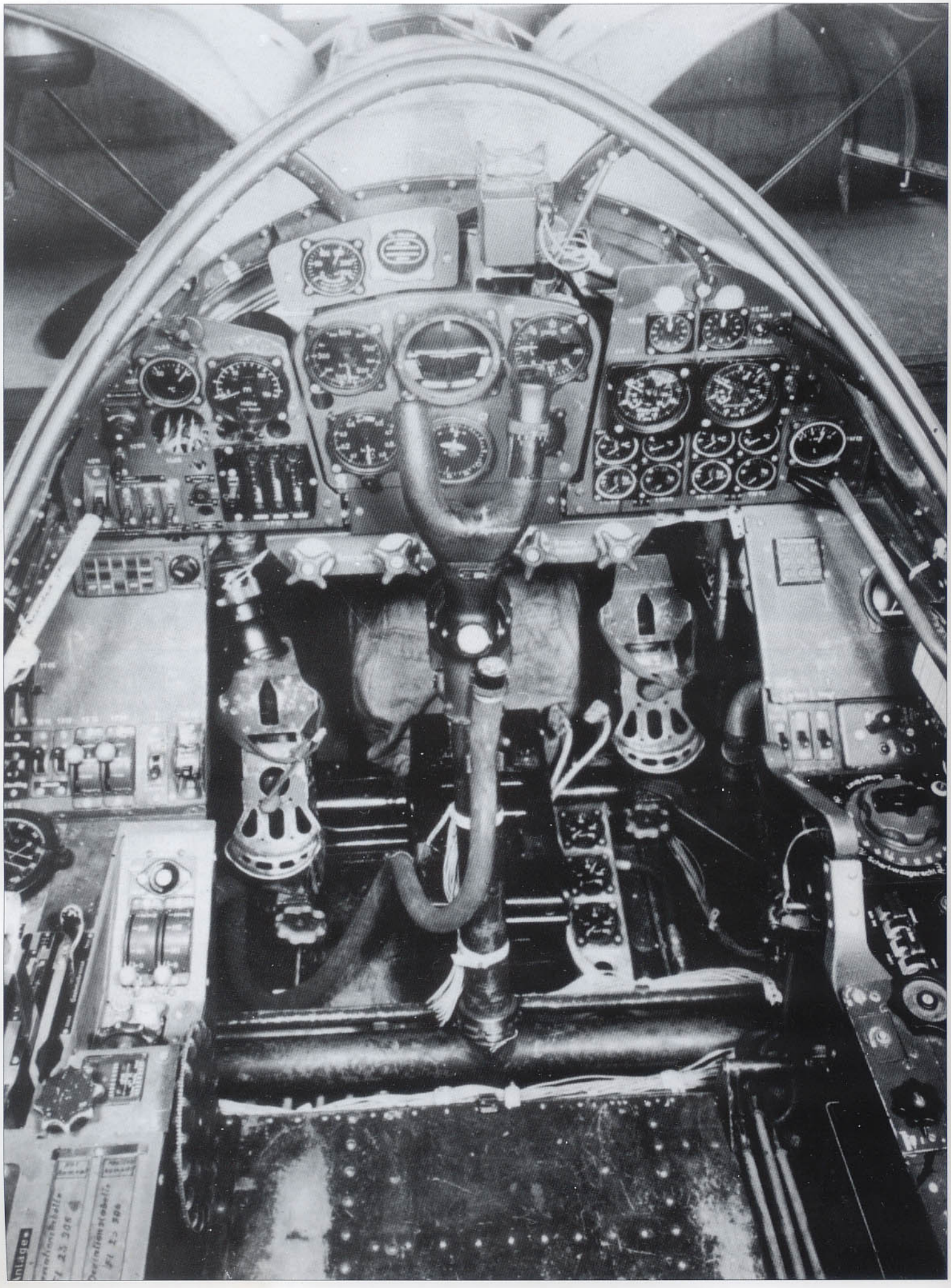


Above: Do 335 A-02, W.Nr. 240102, VG+PH, photographed in Germany soon after restoration in 1975. The Do 335 was probably the fastest propeller-driven fighter of the Second World War thanks to its push-pull twin engine layout combined within its low-drag fuselage.

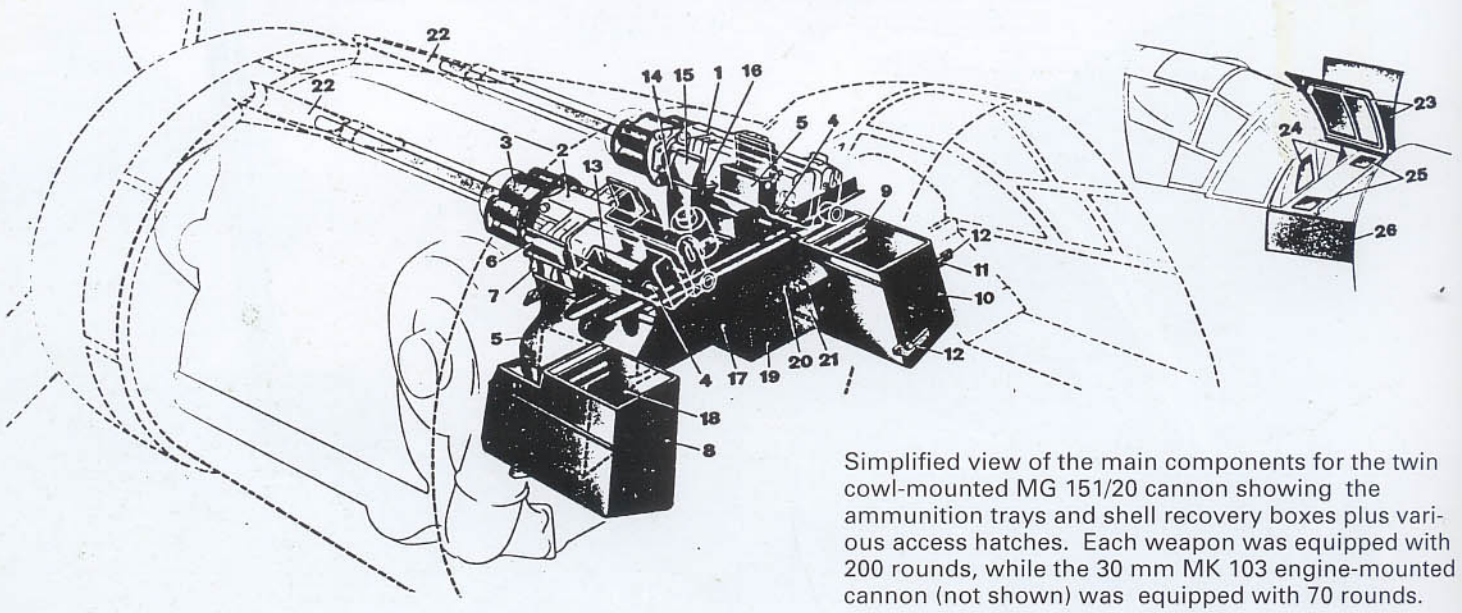
Left and opposite top: Close-up of the port side of the Do 335 V1's canopy showing the blister containing a rear-view mirror. This feature was added to enable the pilot to check the tail section of his aircraft since visibility to the rear was poor. It is interesting to note that the use of rear-view mirrors was confined to the early prototypes of the Do 335. Pre-production and production aircraft dispensed with this feature. Another interesting feature of the early canopies was the opening mechanism. The first and second prototypes were unique in having an innovative method of opening the canopy. It featured a dual arm and extension system whereby the canopy would lift upward and slightly forward, before sliding evenly aft to clear the cockpit. The A-0 pre-production series, as well as all subsequent models, discarded this system for the simple hinge along the starboard edge which allowed the pilot to push the canopy off to the right.



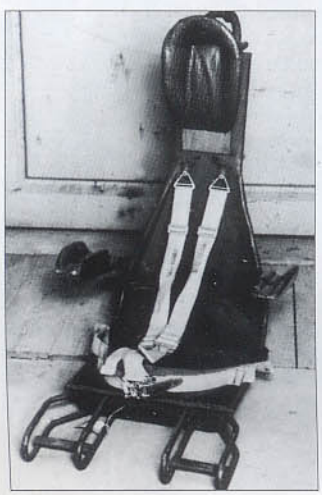
Dornier Do 335 A-0



Left opposite and above: Two views of the cockpit of the Do 335 A-0 which were also applicable to the A-1 series. At the top center of the instrument panel is the Revi 16/D gunsight and to immediate left of this are the oxygen pressure gauge and oxygen regulator. The blind flying panel immediate below contains the airspeed indicator, the turn and bank indicator, the variometer, the altimeter, the repeater compass and the AFN2 radio navigation indicator. To the left of the flight instruments, are the clock, the radio altimeter, the outside air temperature gauge, and the gyro control switch (missing). On the extreme lower left is the landing light switch and above this is the UV lights dimmer switch. The three switches to the right of the landing light switch are for the navigation lights, the instrument panel lights and the pitot heating switch. The square panel on the lower portion next to the flight instruments contains the SZKK3 arming switches. To the right of the flight instruments are located the twin prop pitch indicators (top row), the twin pressure-rpm indicators, and the twin coolant and oil temperature gauges (third row down). The lower row contains the twin fuel and oil pressure gauges. The fuel contents gauge is located in the extreme lower right of the panel. The left horn of the control column holds the bomb release button, while the right horn contains the 30 mm engine-mounted cannon button and the 20 mm cowl cannon trigger on the forward position. The three instruments to the right of the control column are the oil pressure gauge (top), the emergency compressed air gauge (middle) and the ejection seat pressure gauge (bottom). On the forward left console are contained the undercarriage selector lamps, the compass light dimmer switch, the steering switch (far left), the two prop selector switches, the dual prop manual control switches, the flaps switch and the explosive charge switch (next to left rudder pedal) for the rear prop and ventral fin. The left side also contains the canopy lock and release lever (top at an angle) and the twin throttle levers. The right forward console contains the fire warning lamps and the switch for the explosive charge for abandoning the aircraft. Other electrical components are found on the right console including the large circular fuse box selector switch and the FuG 16ZY radio control panel.

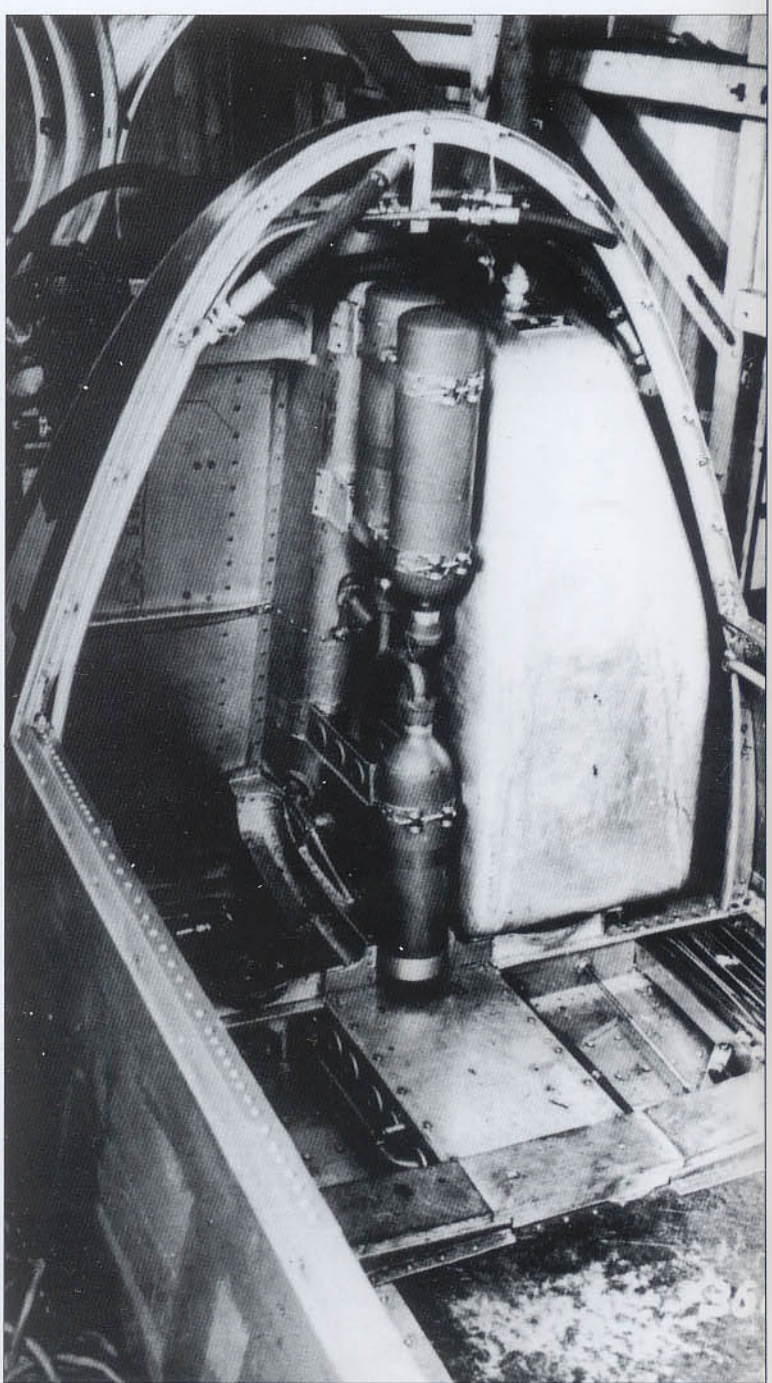


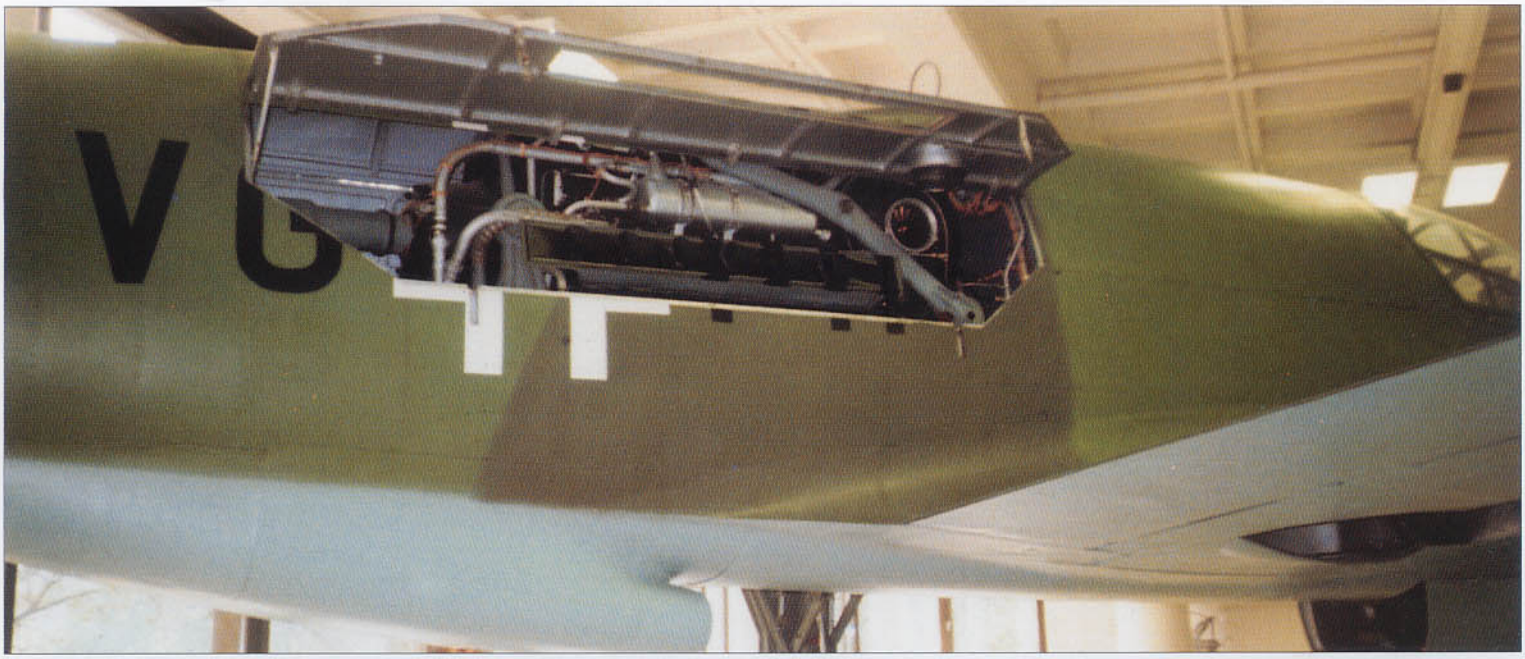
Simplified view of the main components for the twin cowl-mounted MG 151/20 cannon showing the ammunition trays and shell recovery boxes plus various access hatches. Each weapon was equipped with 200 rounds, while the 30 mm MK 103 engine-mounted cannon (not shown) was equipped with 70 rounds.

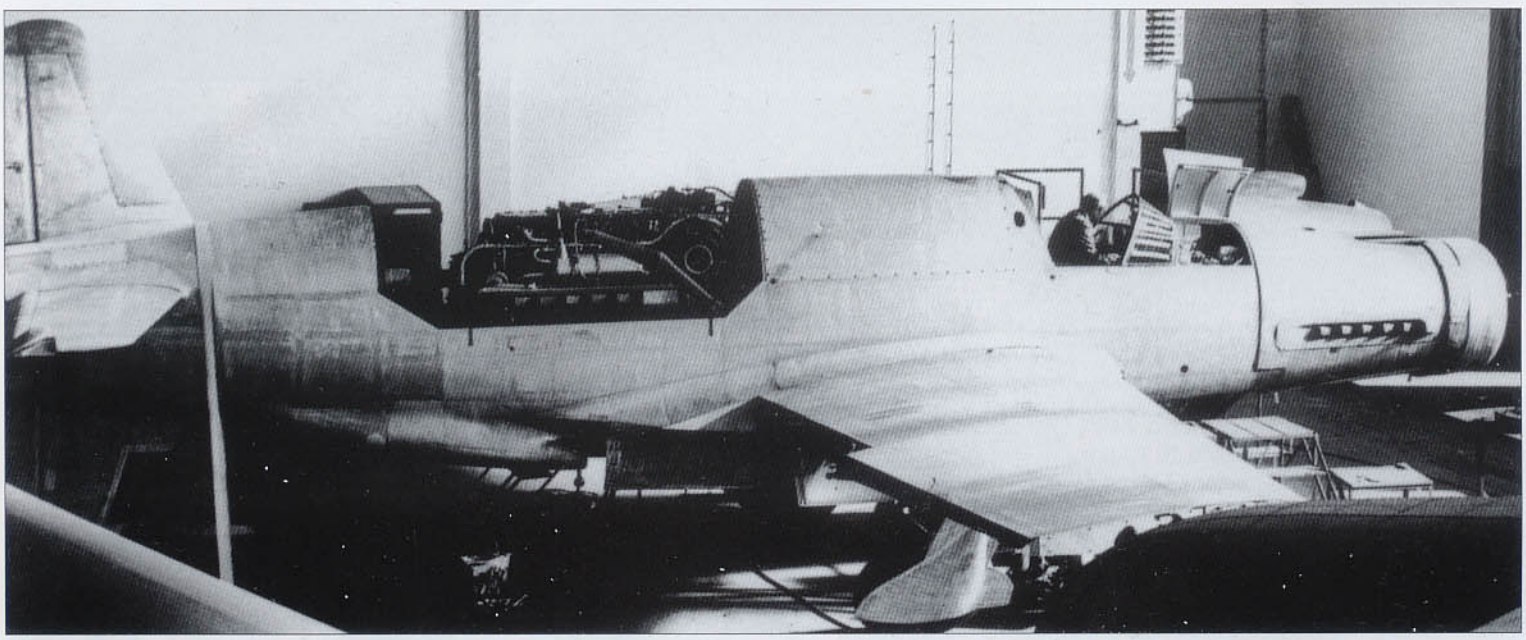


Above and left: Two views of the pilot's ejection seat. The top photograph shows the system installed within the Do 335 V1. If the pilot had to eject from the aircraft, he first drew his legs up and locked his heels onto the stirrups before being ejected.

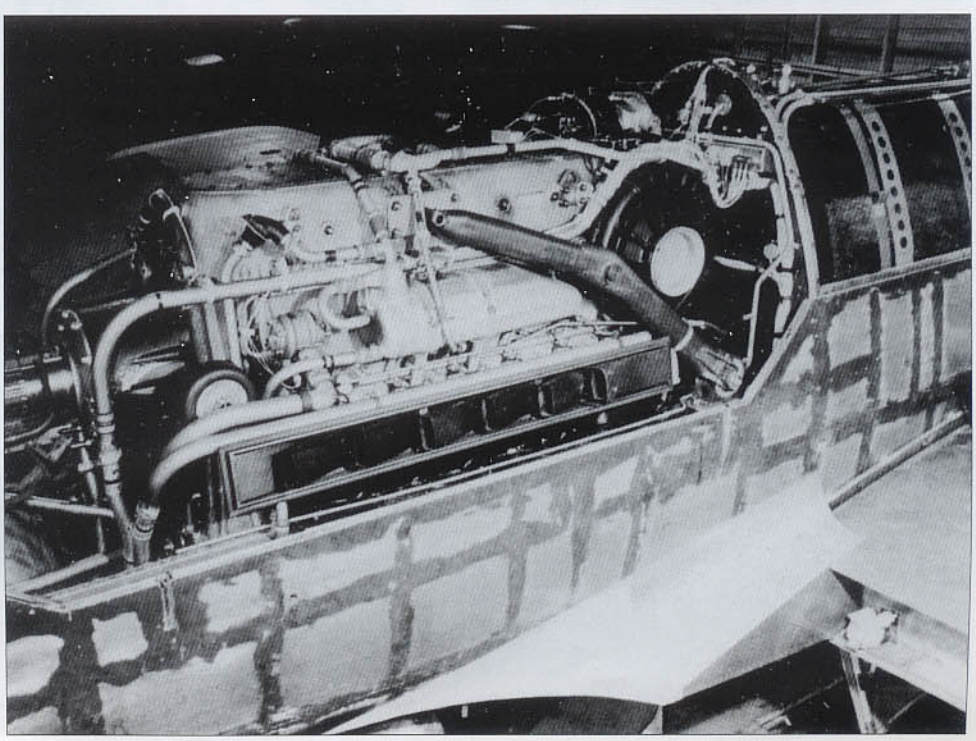
Right: A view immediately aft of the cockpit looking forward showing the three pressurized tanks for GM1 (nitrous-oxide) powerboosting and the starboard 11.8 gal (45 litre) oil tank for the rear engine. An identical tank was fitted on the left side for the forward engine.

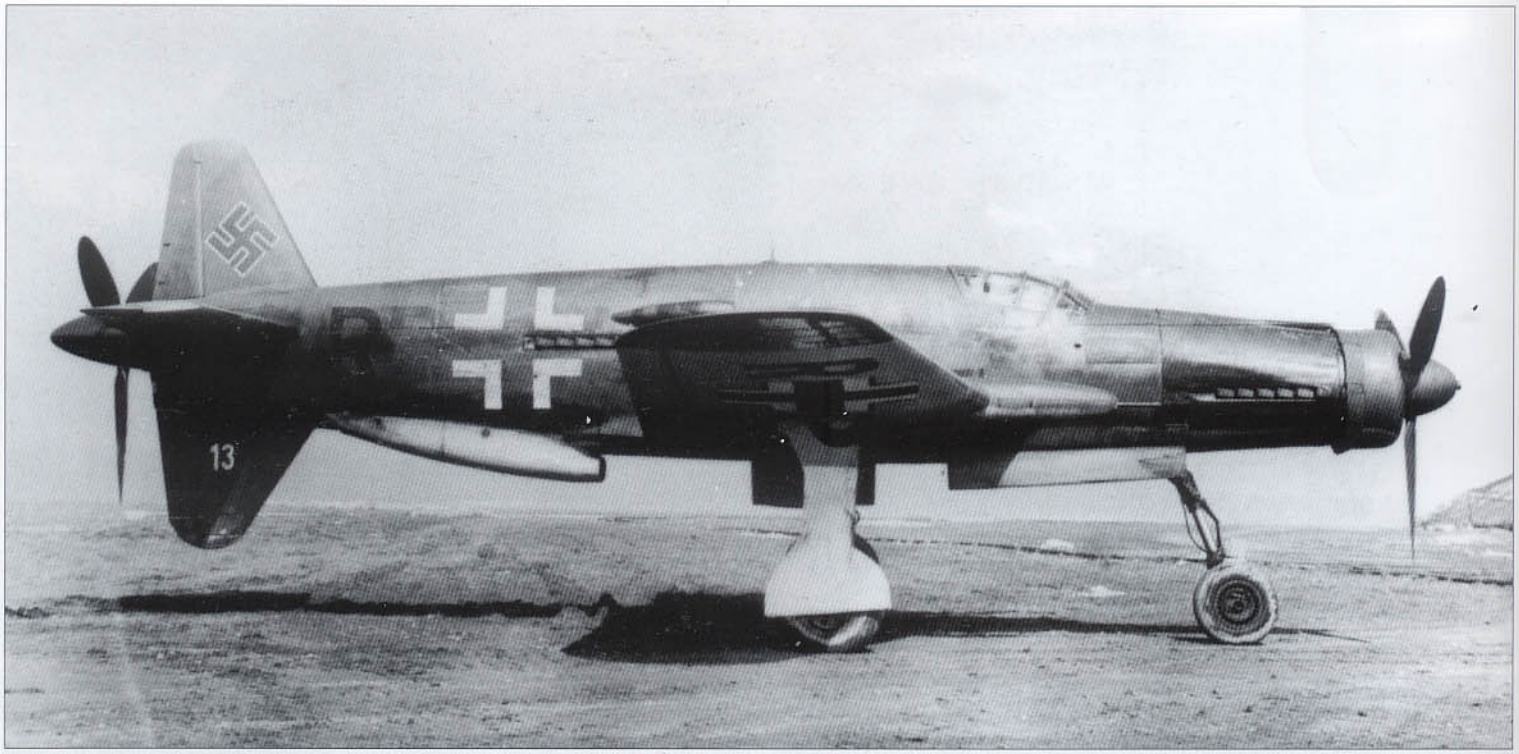






The photographs on this page illustrate the starboard side of the rear engine bay of the Do 335 A-0 showing the DB 603 A-2 in position. This engine drove a VDM metal three-bladed prop of 10 ft 9 in (3.3 m) diameter via a long extension shaft. The forward prop, though similar, was slightly larger, having a diameter of 11 ft 5 in (3.5 m). The main fuel tank was positioned just forward of the rear engine and contained 325 gal (1230 litre) of B4 (87 octane) aviation fuel.





Dornier Do 335 B-2

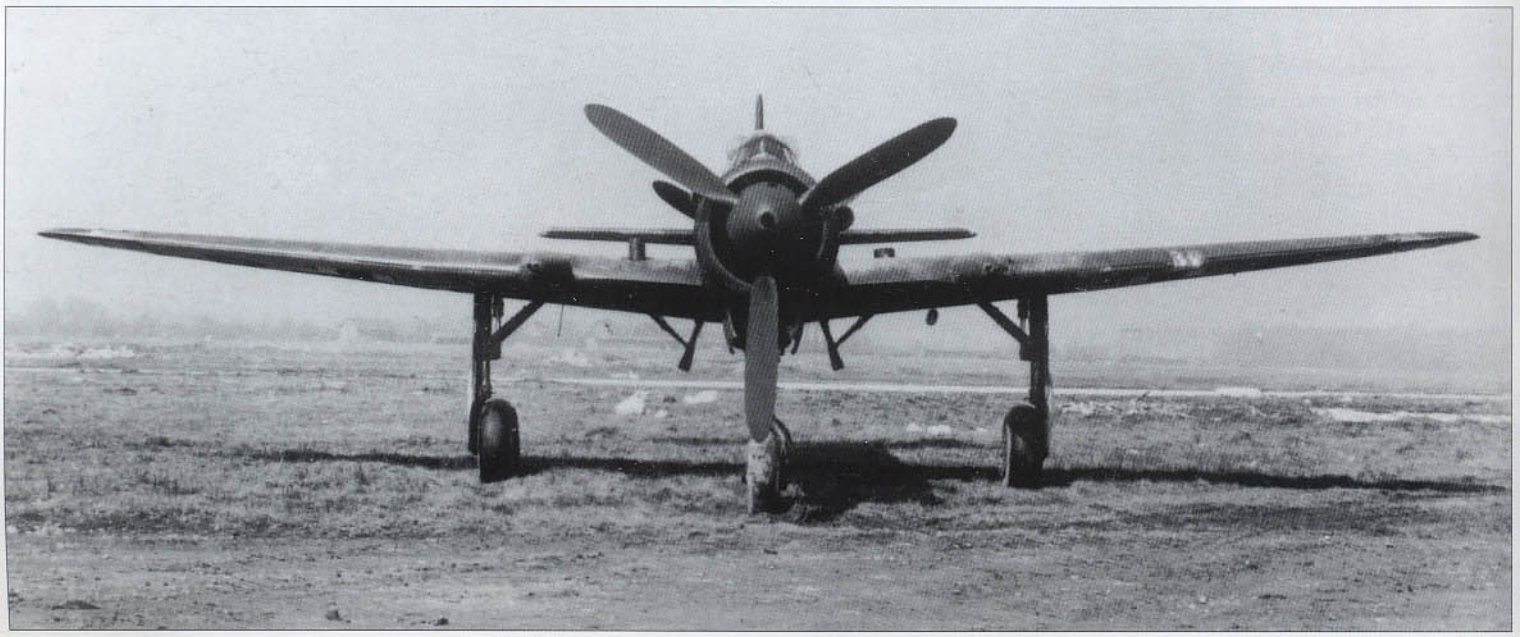
During the summer of 1944, Dornier began work on the improved B-series, which, although generally similar to the A-series, differed in having a slightly revised cabin and a heavily armored windscreen. The Do 335 B-1 day fighter apart from the changes noted above, differed little from the Do 335 A-1. This subtype was passed over in favor of the Do 335 B-2 heavily armed day fighter.

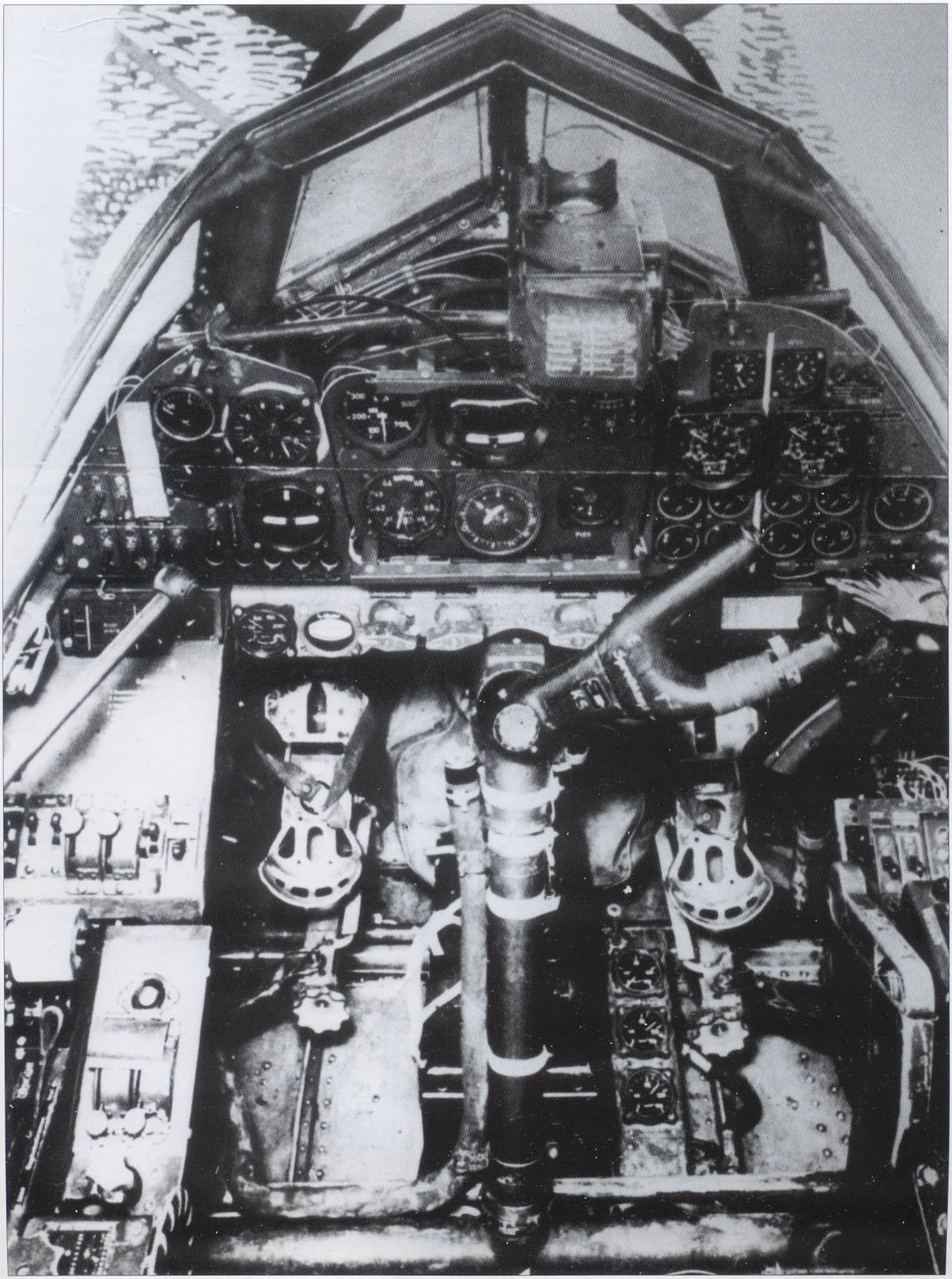
The Do 335 M13 (RP+UP) and M14 (RP+UQ) were the two development aircraft for the B-2 series. This series was characterized by the addition of two wing-mounted 30 mm MK 103 cannon enclosed within special fairings about midway along each wing's leading edge. These weapons and their ammunition caused a reduction in the size of the two internal wing fuel tanks from 82 gal (310 ltr) down to 58 gal (220 ltr) each. In addition, it was determined that the nose wheel had to be increased in size. This required some redesign of the retraction geometry to allow the wheel to swivel 45 degrees when stowed.

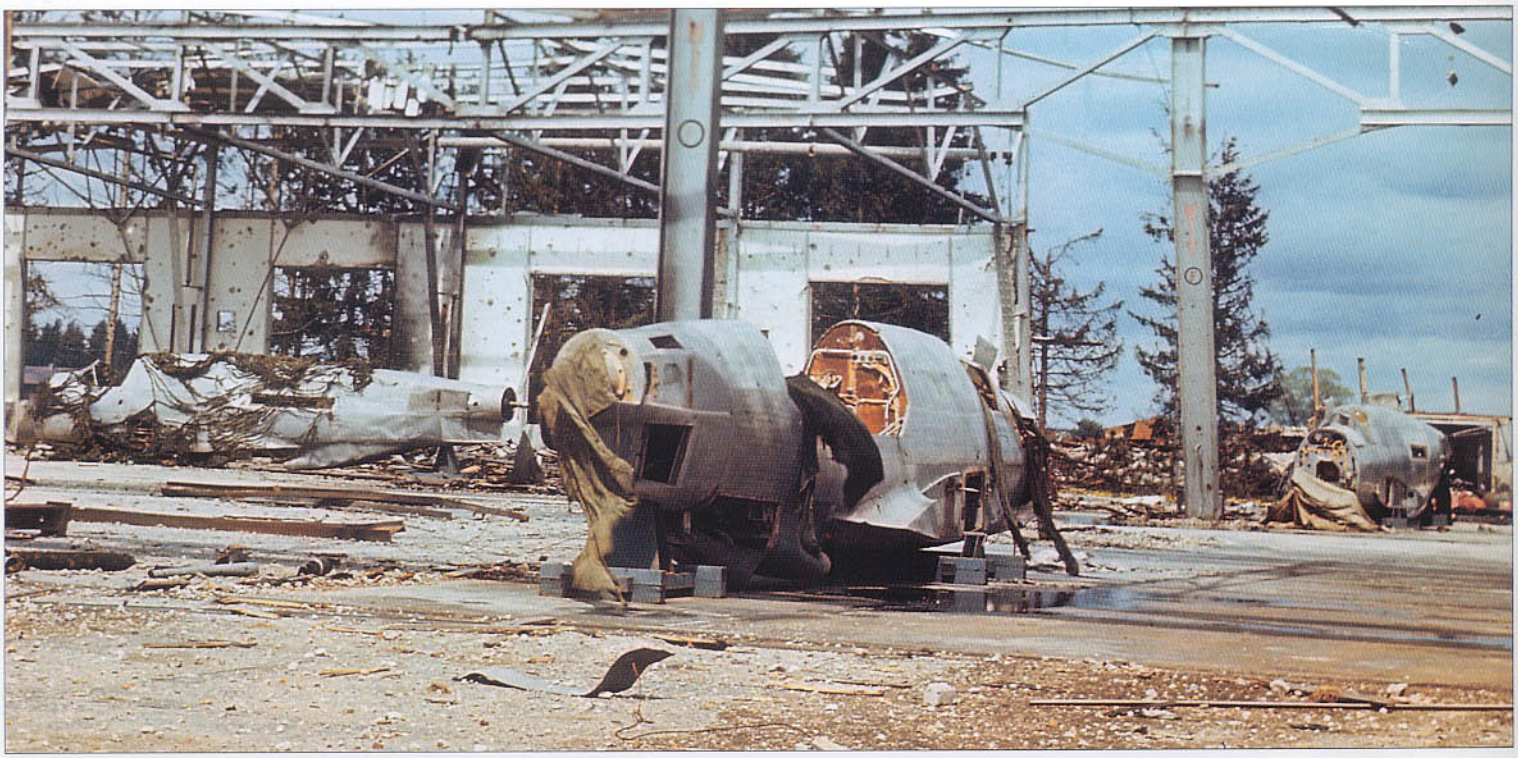
First flown on October 31, 1944, the Do 335 M13 was powered by a DB 603 E-1 in the nose and a DB 603 QE-1 in the aft position. The similar Do 335 M14 was completed in November, 1944, with numerous additional B-2s under construction at Oberpfaffenhofen when the facility was captured by American forces.

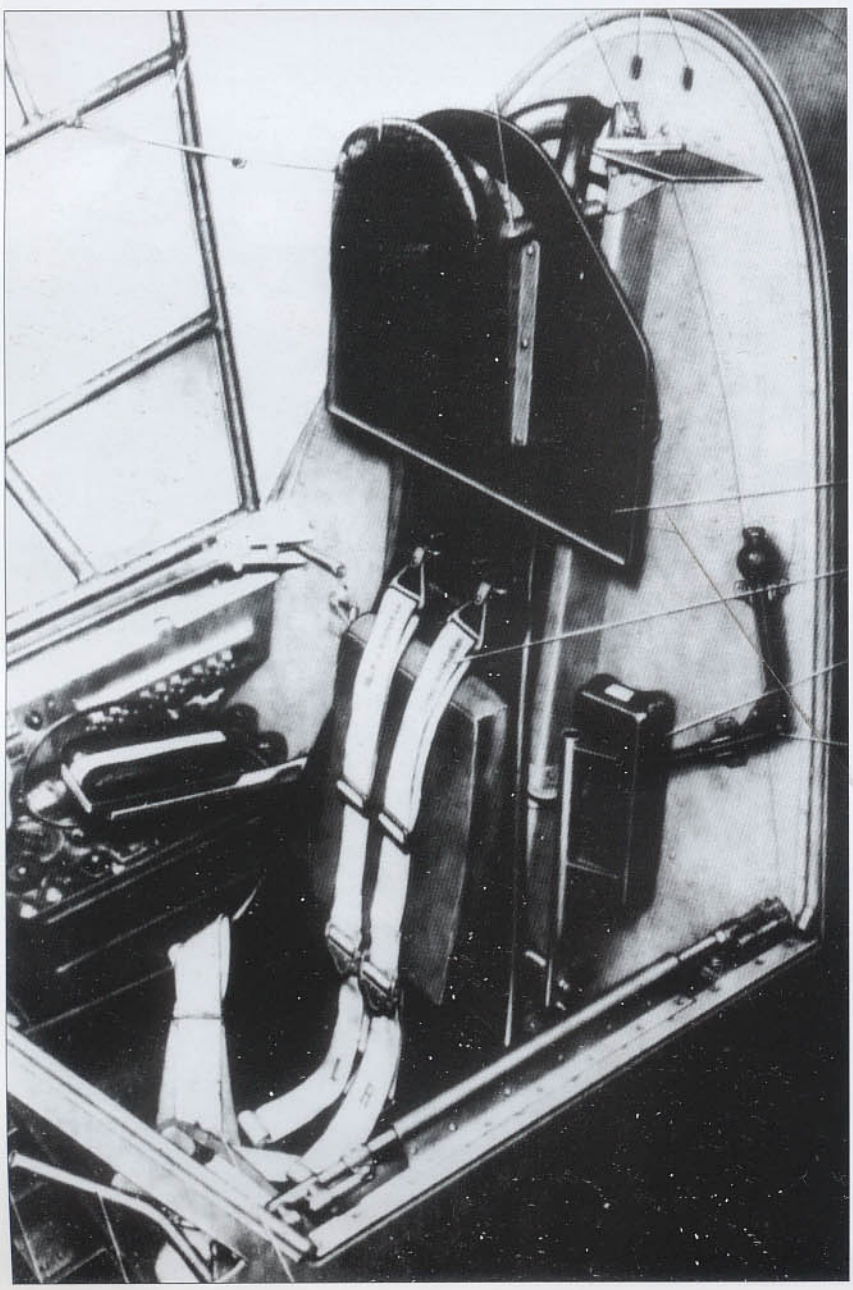
Above and left: Do 335 M13, W.Nr. 230013, RP+UP, photographed at Löwenthal at the end of December 1944 was the first prototype for the Do 335 B-2 heavy fighter series. This series was characterized by its very heavy armament. Two additional 30 mm MK 103 cannon, each with 70 rounds, were contained within the wings.

Right opposite: An overall view of the cockpit of the M13. Note its similarity to the A-series. However, there are differences such as the armored windscreen, the new gunsight, and revision of the four switches mounted under the instrument panel of the A-series (which served as emergency switches for the gear , flaps and bomb-bay doors).



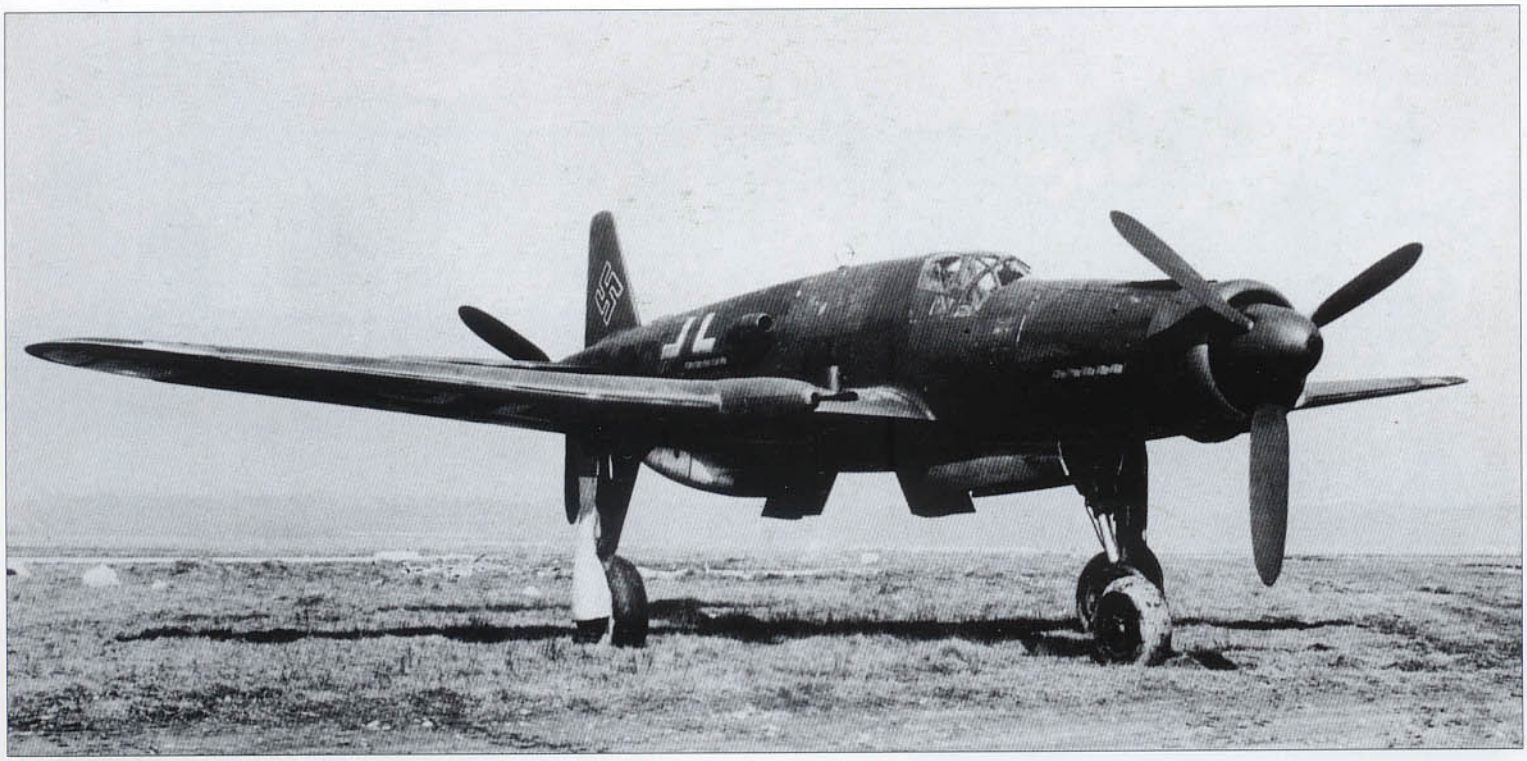






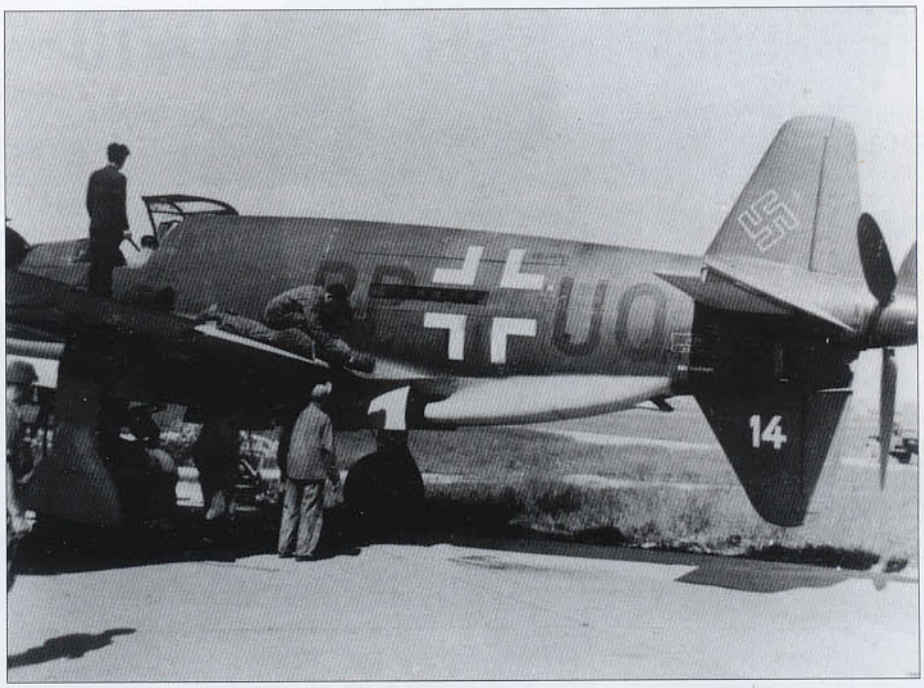
Above: One of several B-series fuselages found partially assembled at Dornier's Oberpfaffenhofen facility. Judging from the condition of hanger, these hulks were abandoned after an Allied bombing attack.

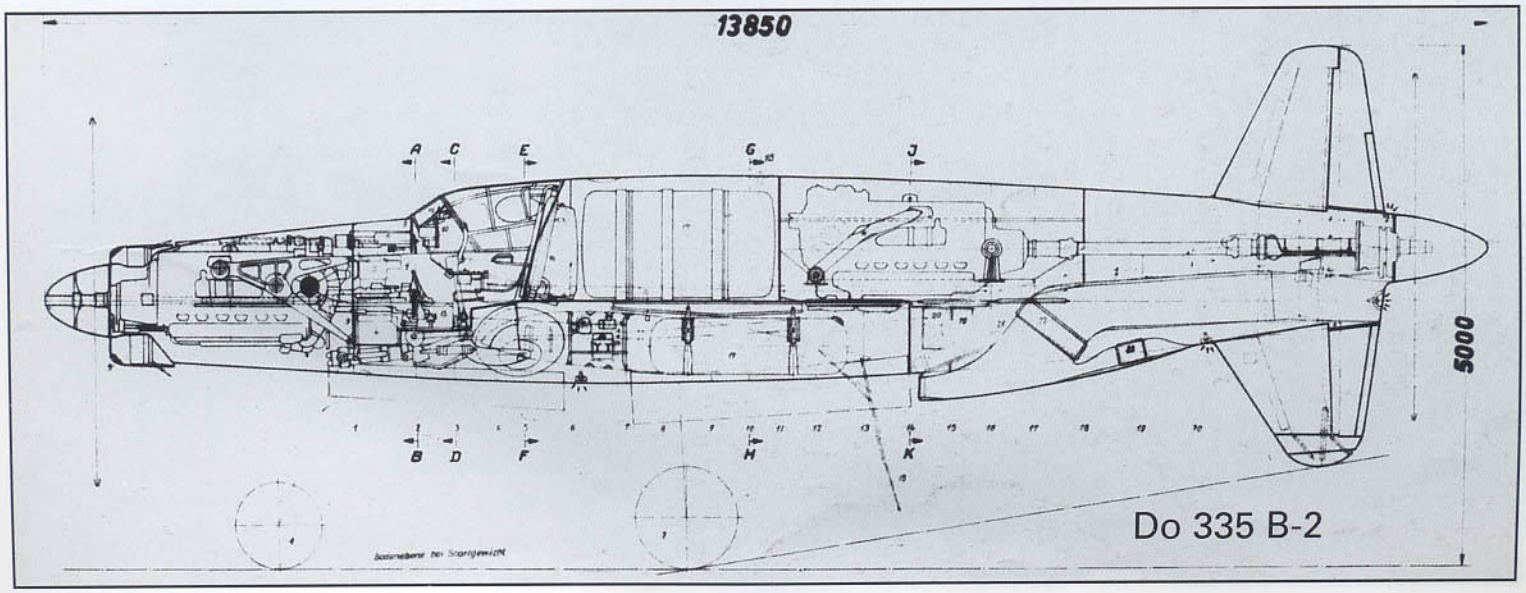
Left: An overall view of the pilot's seat of the M13 showing a number of modifications over that employed by the A-series.

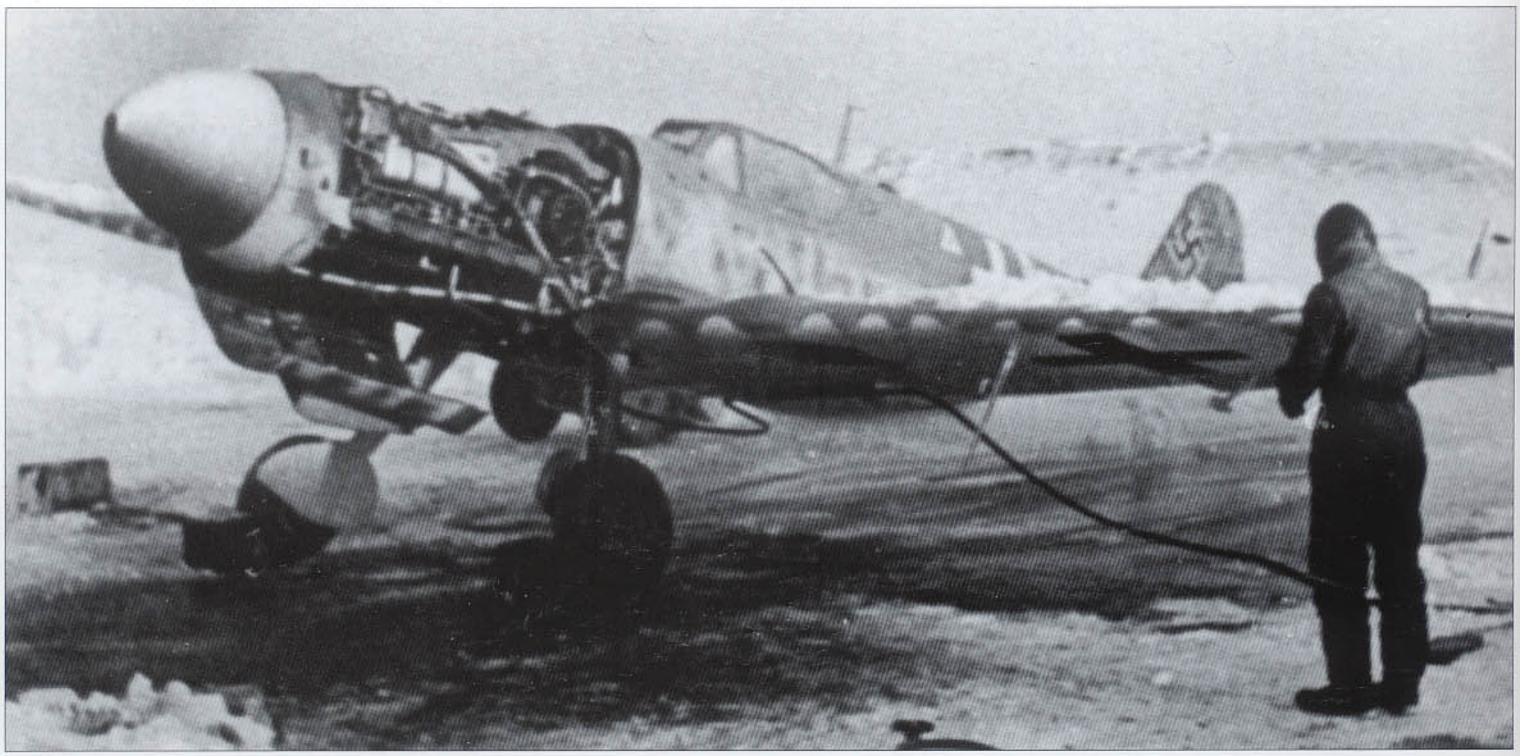


Above: Another view of the Do 335 M13 taken at Löwenthal in December 1944 showing the small, fixed, camera mounted above the starboard wing near the fuselage. The precise purpose of this camera is unclear.

Right: A view of the second prototype for the B-2 series, the Do 335 M14, W.Nr. 230014, RP+UQ, after capture by American forces. This aircraft was eventually given over to the French for testing and evaluation.





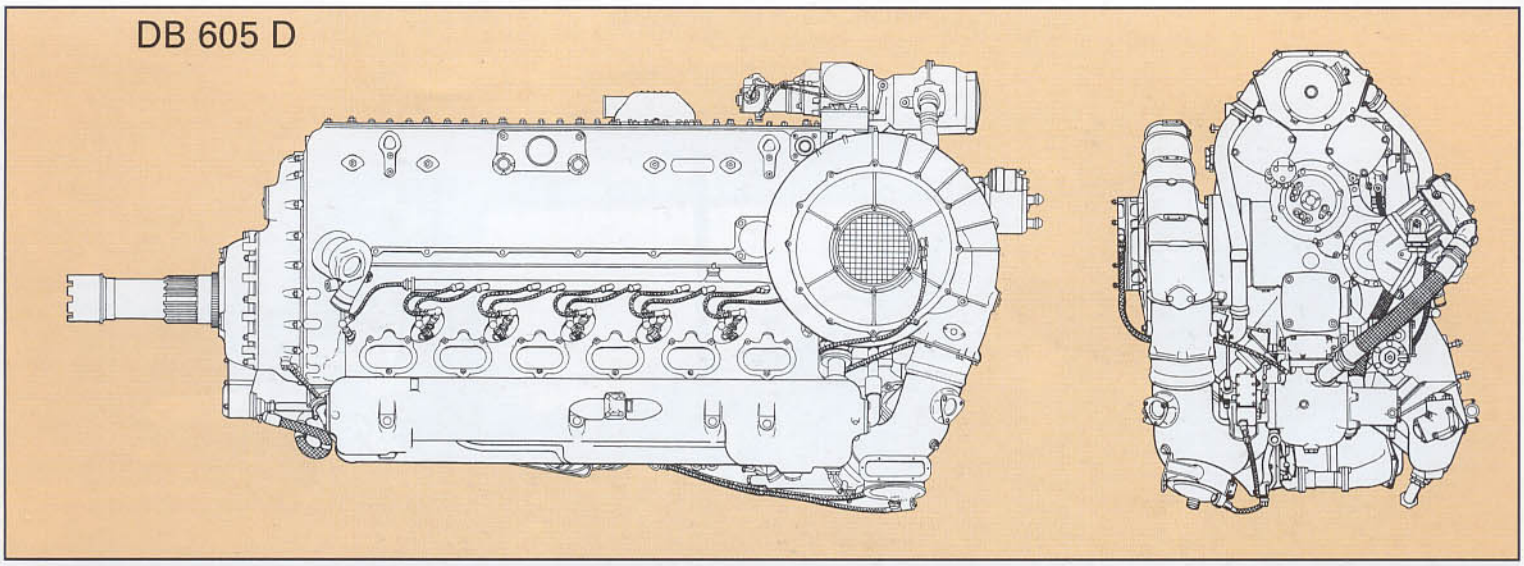


Messerschmitt Bf 109 G-10

Appearing for the first time in early November 1944, the Bf 109 G-10 was probably the fastest sub-type of the G-series. Powered by a DB 605 DCM driving a metal, three-bladed VDM 9-12159 propeller, the new engine incorporated the larger supercharger of the DB 603G, plus increased compression ratios. As its designation suggests, it also required C3 fuel (96 octane), coupled with MW 50 powerboosting. The new larger engine required modification to the engine mounting and upper cowling contours. In addition, a new and deeper oil cooler, type Fo 987, was fitted to the lower nose cowling, which also had been modified to enclose the enlarged camshaft covers. Another version of the G-10 was an interim model known as the Bf 109 G-10/AS. This fighter, powered by the DB 605AS engine, also appeared in November, 1944, but was considered only a stop-gap variant until the flow of DB 605 D engines became more constant. Relatively few of these fighters, characterized by their slightly different cowling and forward fuselage contours, were manufactured.

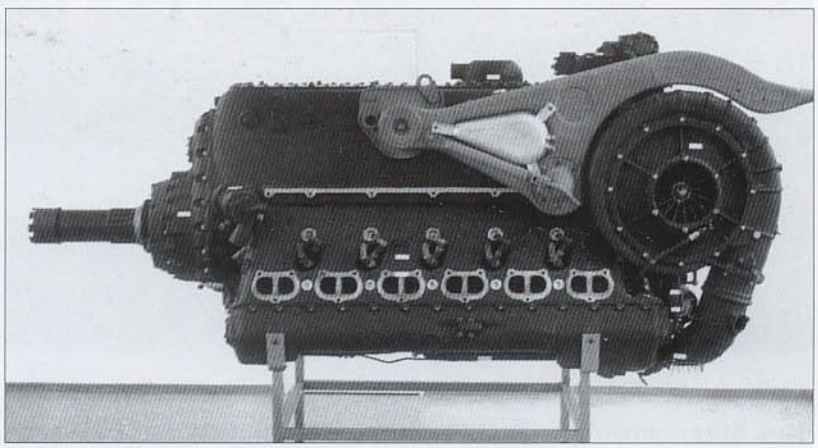
Above: A standard Bf 109 G-10 being run-up at the WNF facility near Vienna during the last winter of the war.

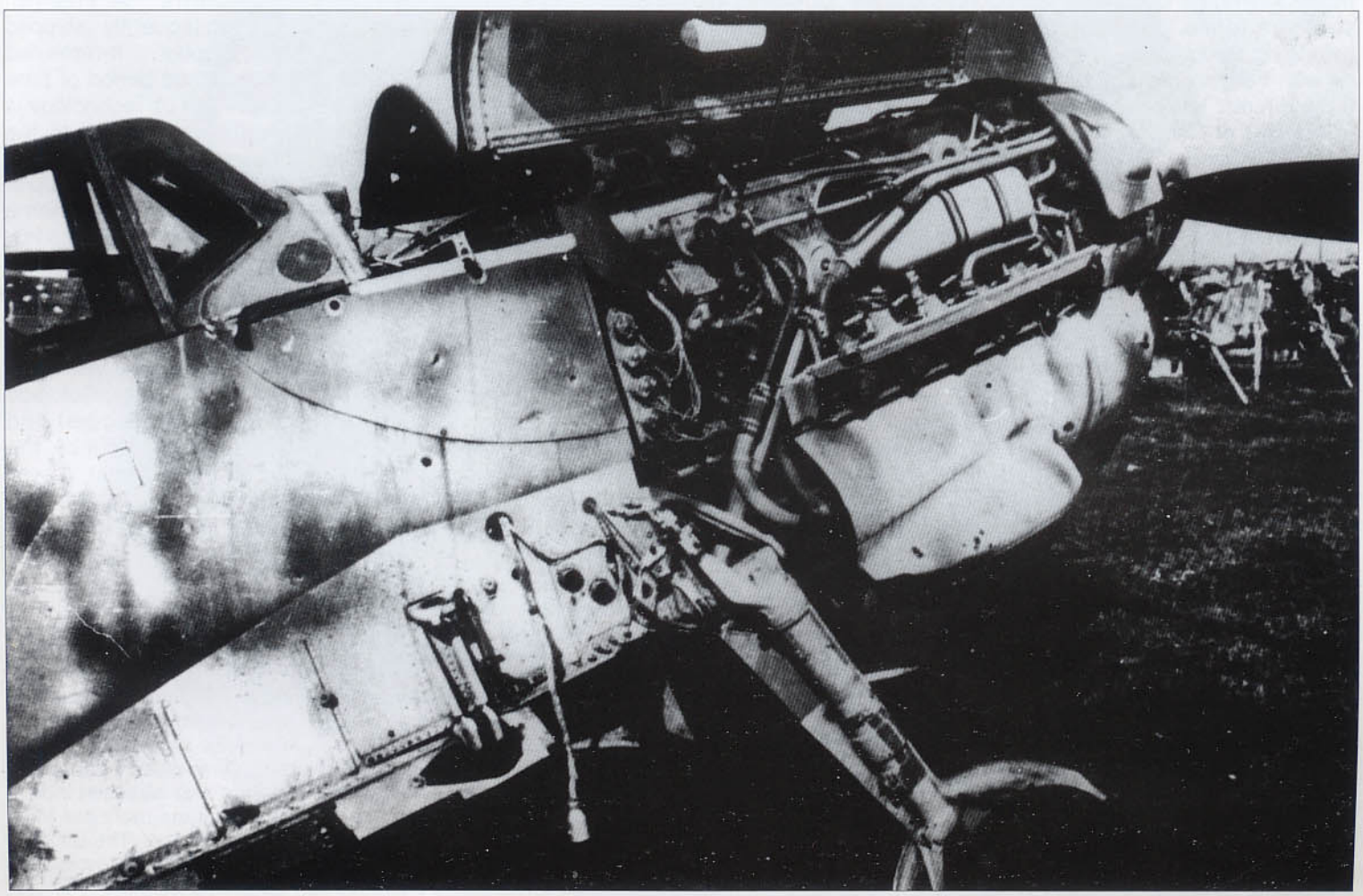
Below: Photographed at the Langensalza airfield are the remains of a Bf 109 G-10/AS, W.Nr. 150816, black 4, formerly of 6./JG 51.



Right: A side view of a Daimler-Benz DB 605 DC with engine bearer arm in position. This powerplant was a twleve-cylinder inverted vee liquid-cooled 35.7 litre engine with a bore and stroke of 154 x 160 mm and a compression ratio of 8.3/8.5: 1 requiring C3 fuel (DB 605 DC without MW 50)or B4 fuel (DB 605 DBM with MW 50). The supercharger was a single-stage type of increased size adapted from the DB 603 G engine. This 1944 engine was a development of the DB 605 A with a new supercharger and certain internal changes. It developed 2,000 hp ar 2800 rpm for take-off.

Below: A close-up of the starboard side of a derelict Bf 109 G-10 showing wing root and engine compartment detail.



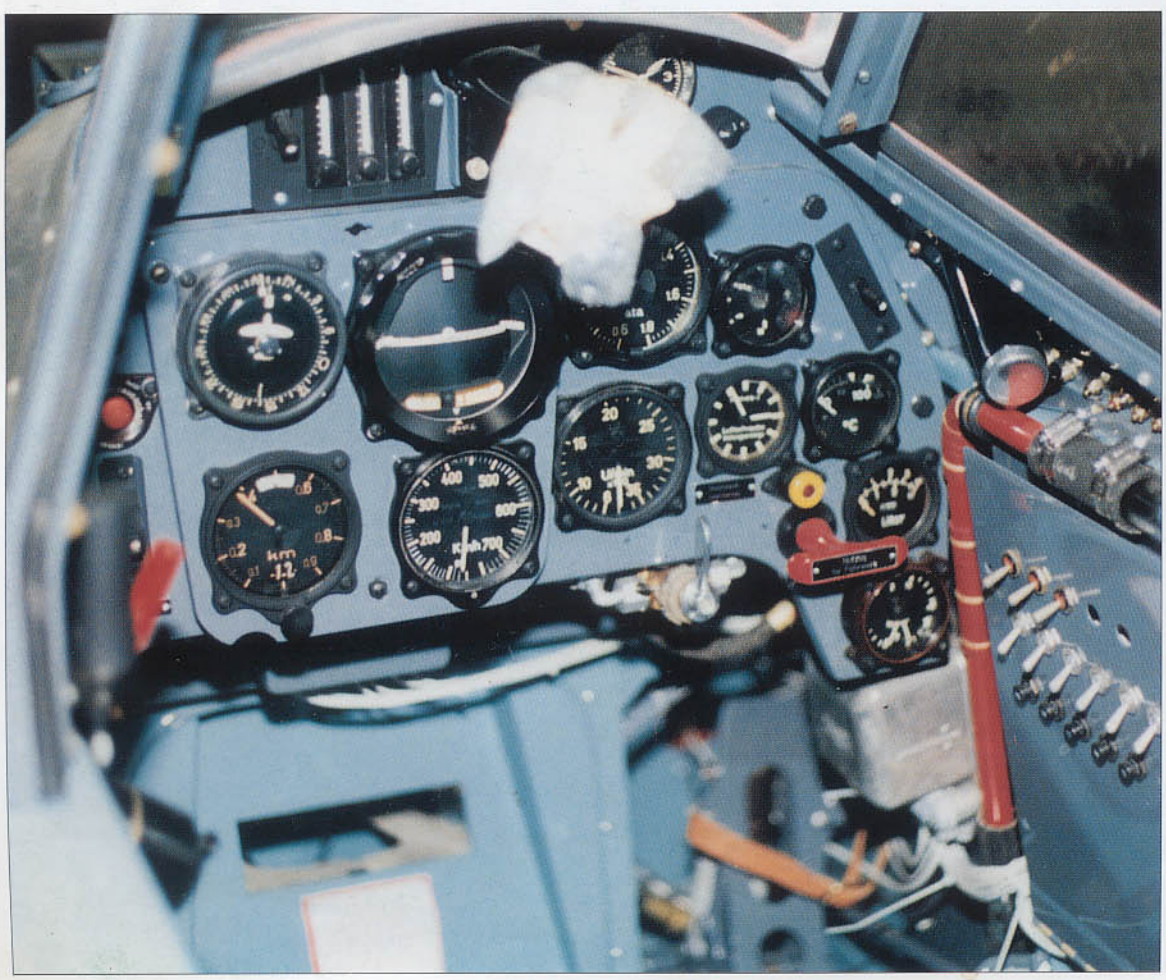


The American Messerschmitts: At the end of the war, three examples of the Bf 109 G-10/U4 were selected for shipment to the United States from a contingent of aircraft, belonging to II./JG 52, which had surrendered at Neubiberg airfield. Following a short test flight by American pilots, the three aircraft were disassembled and transported by trucks to the port of Cherbourg where they were placed aboard the Royal Navy escort carrier HMS Reaper. Once in the States, the three Messerschmitts were then shipped to Freeman Field, Indiana. Foreign Equipment numbers were assigned to each aircraft (FE-122, 123 and 124) and each was assembled for static display. The aircraft shown on this page and opposite is Bf 109 G-10/U4, W.Nr. 611943, yellow 13, which was assigned USAAF number FE-122. In June 1946, this aircraft was transferred to Wright Field for display purposes, but by 1947 it was declared surplus. In 1948, as T-2-122, it was donated to the University of Kansas at Lawrence, Kansas. A year later the university sold the Messerschmitt to Edward Fisher of Kansas City, Kansas, who in 1956, in turn sold the fighter to Edward Maloney for his Planes of Fame Museum, located at Chino airfield, California. Finally, in the summer of 1959, Maloney had the aircraft trucked to his new museum in California. Over the years it has been repainted a number of times, but the photographs shown here represent the aircraft in its present condition following restoration and repainting at the Planes of Fame Museum.

The second Messerschmitt, Bf 109 G-10/U4, W.Nr. (unknown), black 7, FE-122, was also shipped to Wright Field in 1946 and, restored to static display condition. In 1948, when the Air Force became a separate service branch, the aircraft was repainted and its Foreign Equipment number changed to T2-123 (T2 = Intelligence). The subsequent fate of this Messerschmitt fighter is unknown. Interestingly, *only four* photographs of this aircraft are known to exist (none shown).

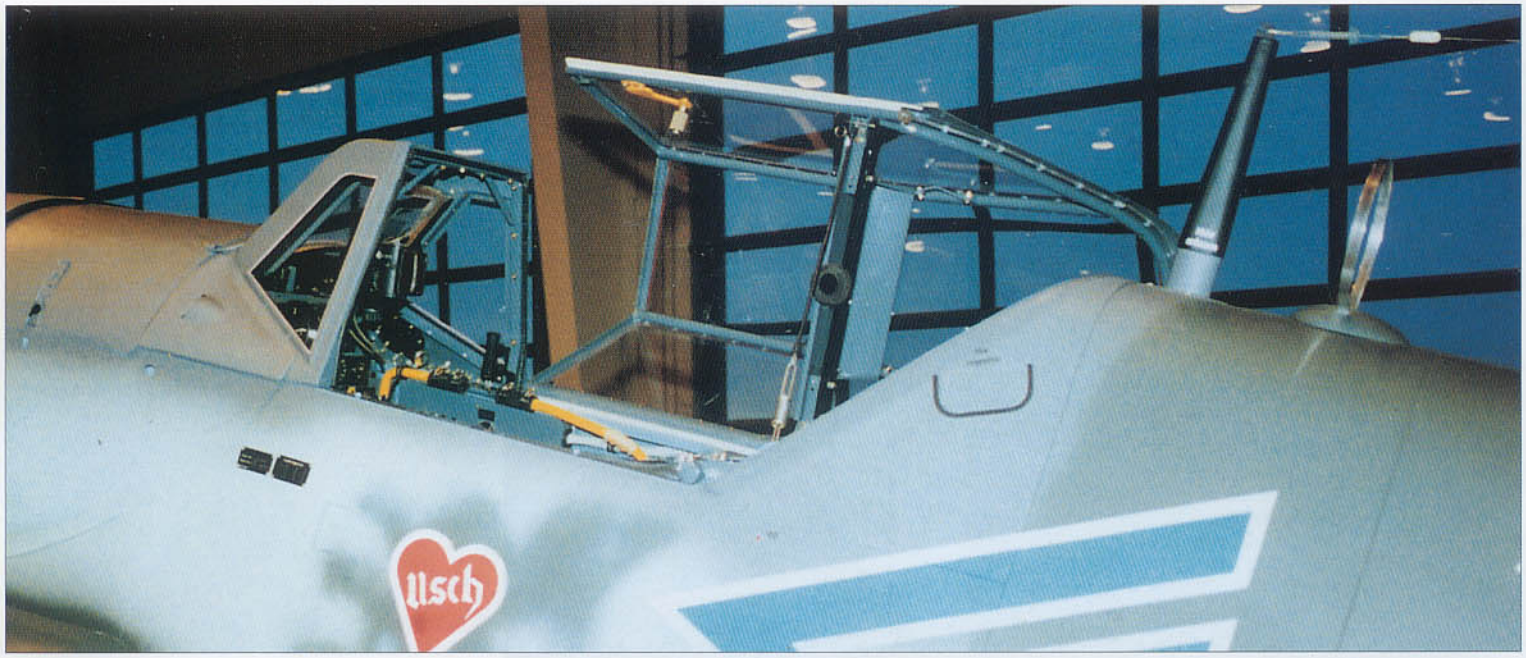
The third Messerschmitt, shown on page 198, is Bf 109 G-10/U4, W.Nr. 610937, (unit number unknown) . At Freeman Field it became FE-124 and was also subsequently shipped to Wright Field in June 1946 for static display. It remained at Wright Field, as T2-124, for an undisclosed period of time before being offered to the Georgia Institute of Technology in Atlanta. By 1959, this Messerschmitt was surplus to the needs of Georgia Tech and resultingly the aircraft was purchased by John W. Caler of Sun Valley, California. In June 1959, it was transported by flatbed truck to Caler's home where restoration was begun. After more than two decades, restoration work was still unfinished, the fighter was sold in 1984 to Douglas Arnold of Bitteswell, Great Britain. In 1990, the Messerschmitt was purchased by Evergreen Aircraft of McMinnville, Oregon for the purpose of completing restoration to airworthy condition. This activity took five years and was undertaken by Vintage Aircraft of Fort Collins, Colorado (airframe), the Daschel firm of Germany (engine) and Hoffmann Propeller in Germany (propeller). Since the wartime paint scheme for this aircraft is unknown, it was decided to paint the fighter in the authentic colors and insignia of Germany's greatest ace, Erich Hartmann.

Above and opposite: Currently located at Ed Maloney's Planes of Fame Museum at Chino Airport near Los Angeles, California is Bf 109 G-10/U4, W.Nr. 611943. The interior of this variant of the famous Messerschmitt fighter, which was closely patterned after the G-6 series, lacks its Revi gunsight and airspeed indicator. Note the large breech cover for the engine-mounted MK 108 cannon directly in front of the control column. The U4 designator indicated the presence of the 30 mm MK 108 instead of the 20 mm MG 151/20 normally carried in this location.

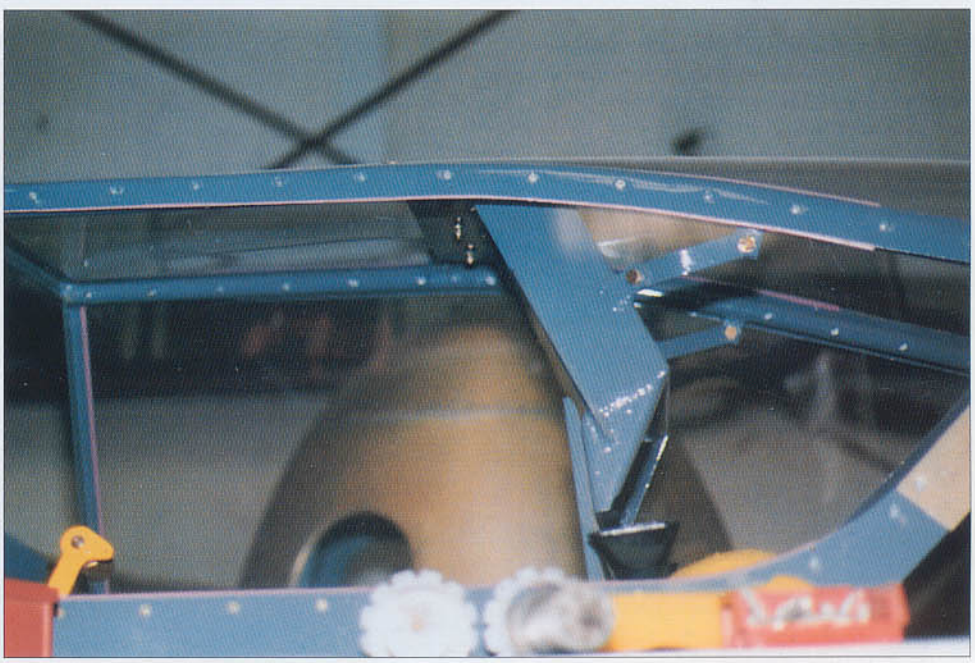


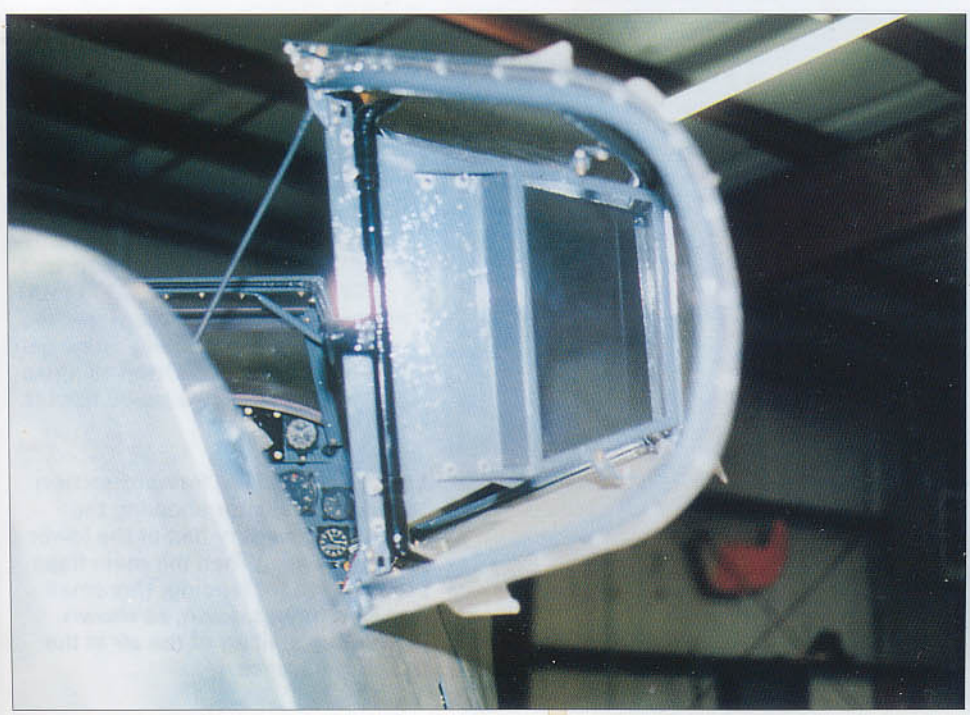
Above: Photographed on December 18, 1995 at McMinnville, Oregon, is Bf 109 G-10/U4, W.Nr. 610937, ex T2-124, upon completion of a five year restoration program designed to bring the Messerschmitt to airworthy condition. The aircraft has been faithfully repainted in authentic colors and insignia to represent the fighter flown by Erich Hartmann of I./JG 52.

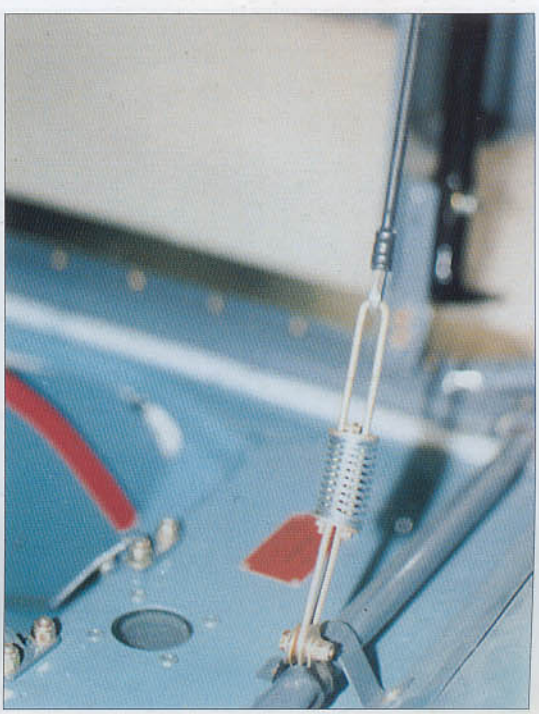
Left: The restored cockpit of W.Nr. 610937. Although most of the instruments are original, a great deal of license has been taken with respect to the interior colors and certain up-dated avionics. Note that the engine-mounted cannon and its breech cover have been omitted. White plastic covers the gunsight attachment post.

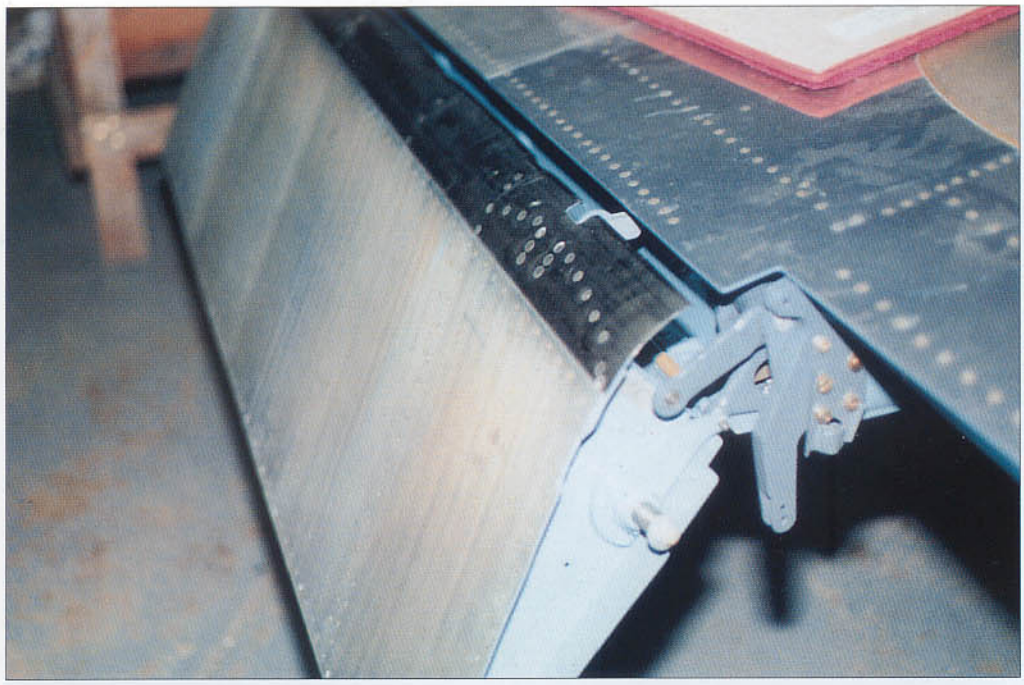


All photographs on this page depict various features of the Erla canopy fitted to Bf 109 G-10/U4, W.Nr. 610937. This canopy design was standard equipment for most late war Messerschmitt Bf 109s and was also retro-fitted to many earlier variants including the Bf 109 G-5, G-6 and G-8. Unlike the earlier three-piece canopies, this model had no provision for direct cockpit ventilation. Note the pilot's bullet-resistant glass affixed to the canopy side rails.



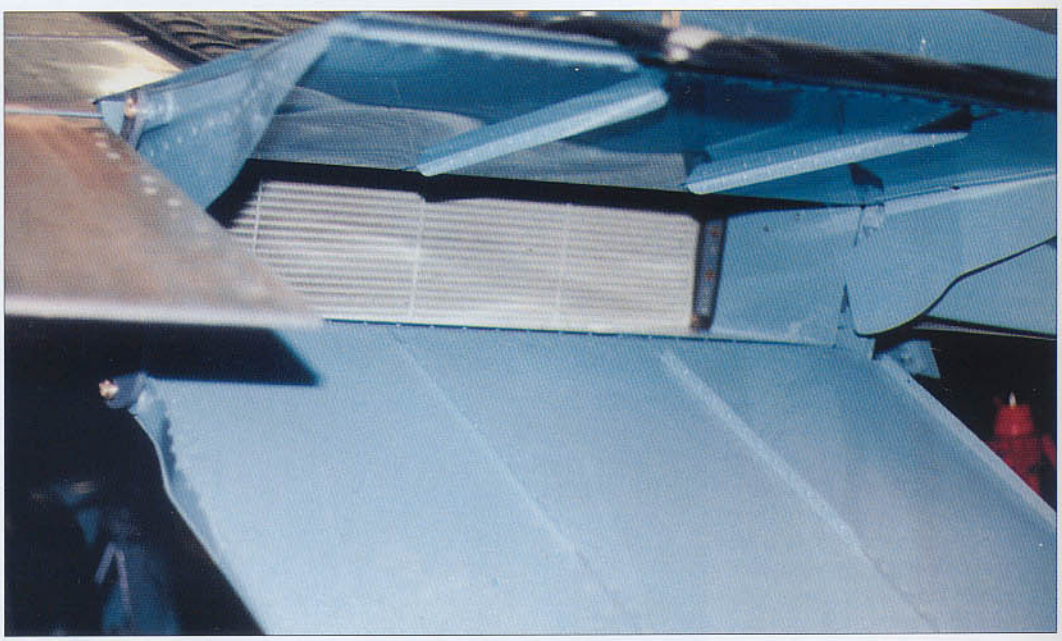


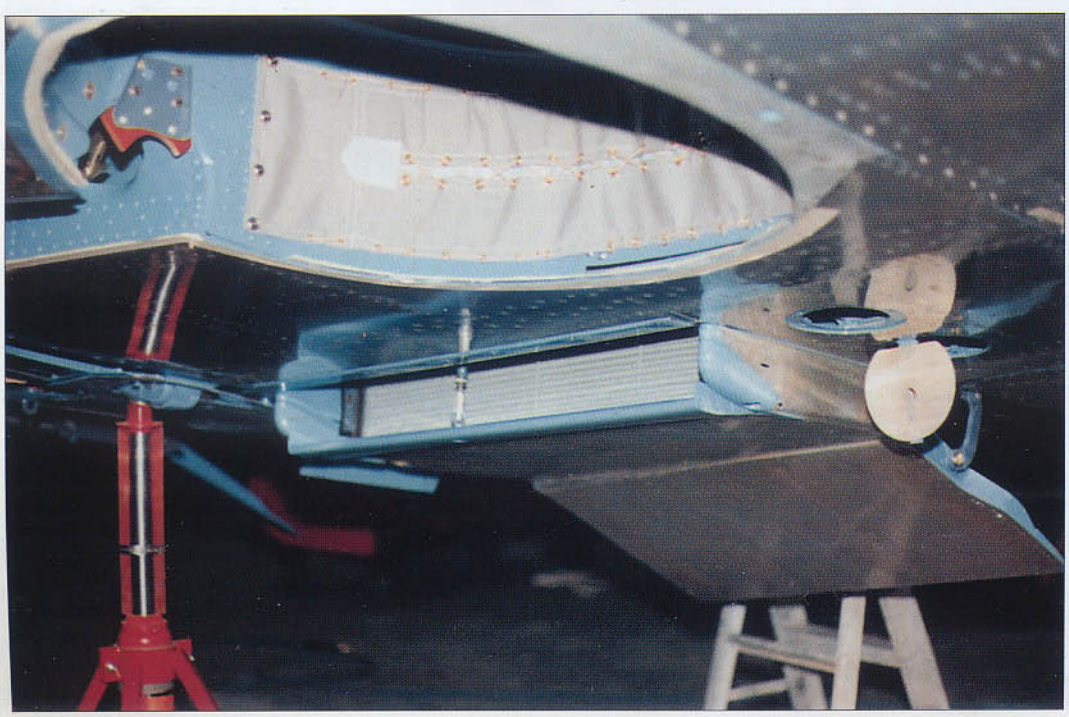




Left: Detail view of the port main flap and control crank for the Evergreen Aviation's Bf 109 G- 10/U4. The flap is of the camber-changing type of metal construction with a fabric covering. This flap design was first introduced on the F-series and remained largely unchanged throughout the war.

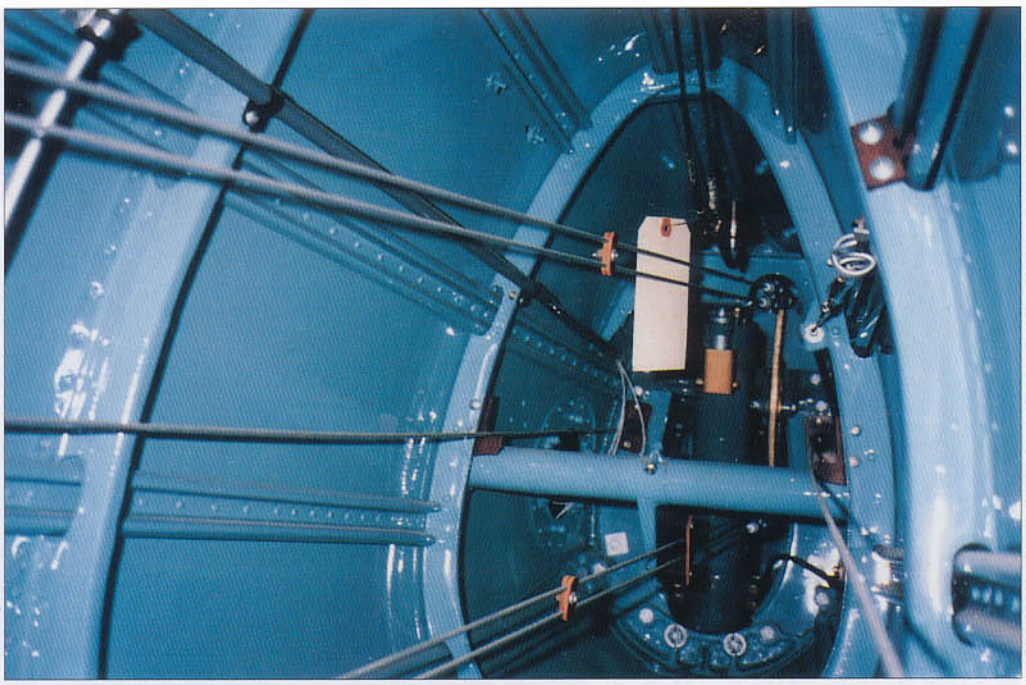
Right: A close-up of the port radiator and split flap. When the pilot lowers the flap for landing, the top flap drops and the lower section moves progressively ahead of it at a greater angle, thus maintaining the flow of cooling air.

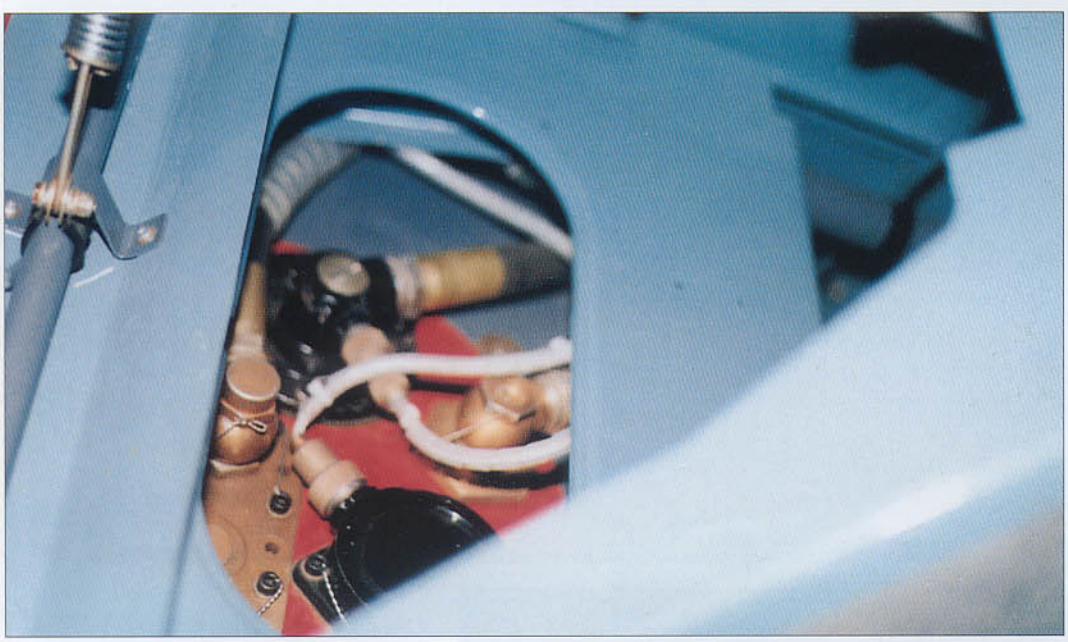




Left: A view of the forward section to the port radiator showing the unusual secondary flap at the lower leading edge. When the main flaps are lowered for landing, this small flap also moves down, as shown, preventing stalling of the air at the radiator entrance.

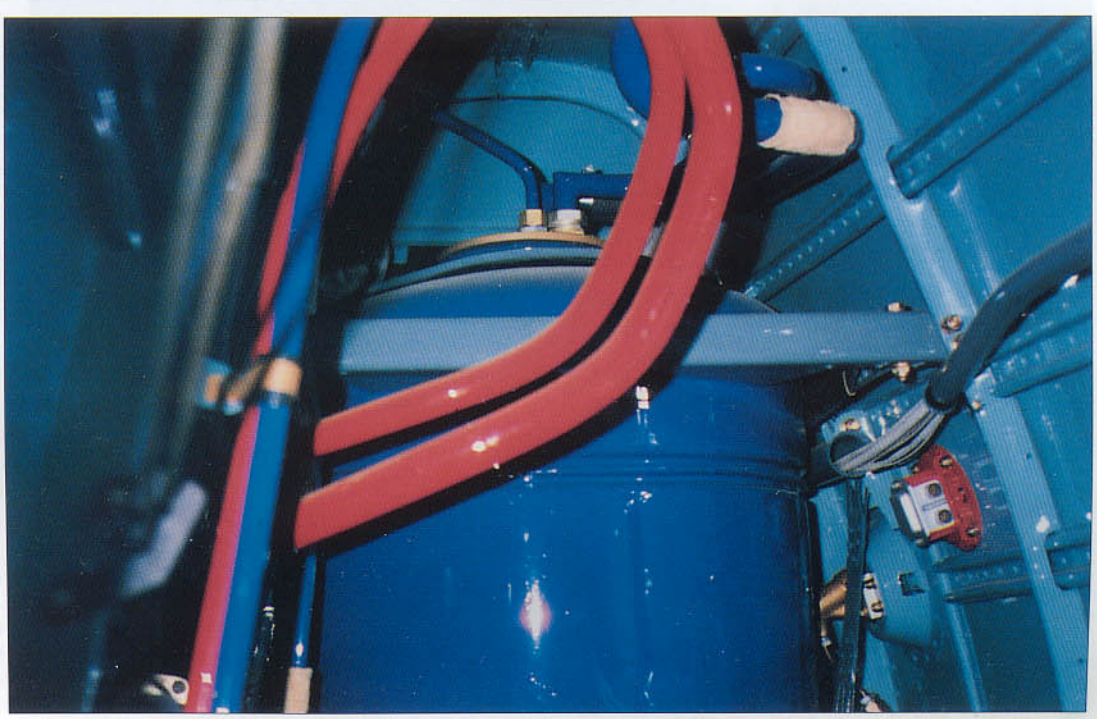
Right: A view of the rear fuselage of W.Nr. 610937 showing the control rods and the lifting and tie-down shaft. The light weight rear fuselage was extremely strong in spite of the fact that it did not employ standard frame sections, but instead relied upon metal sections that had been formed so as to lock into with each other. These were connected to top-hat stringers at their respective seams for added strength. When originally manufactured, this area was not painted. The special finish shown here is intended as an anti-corrosion measure rather than a cosmetic application of paint.





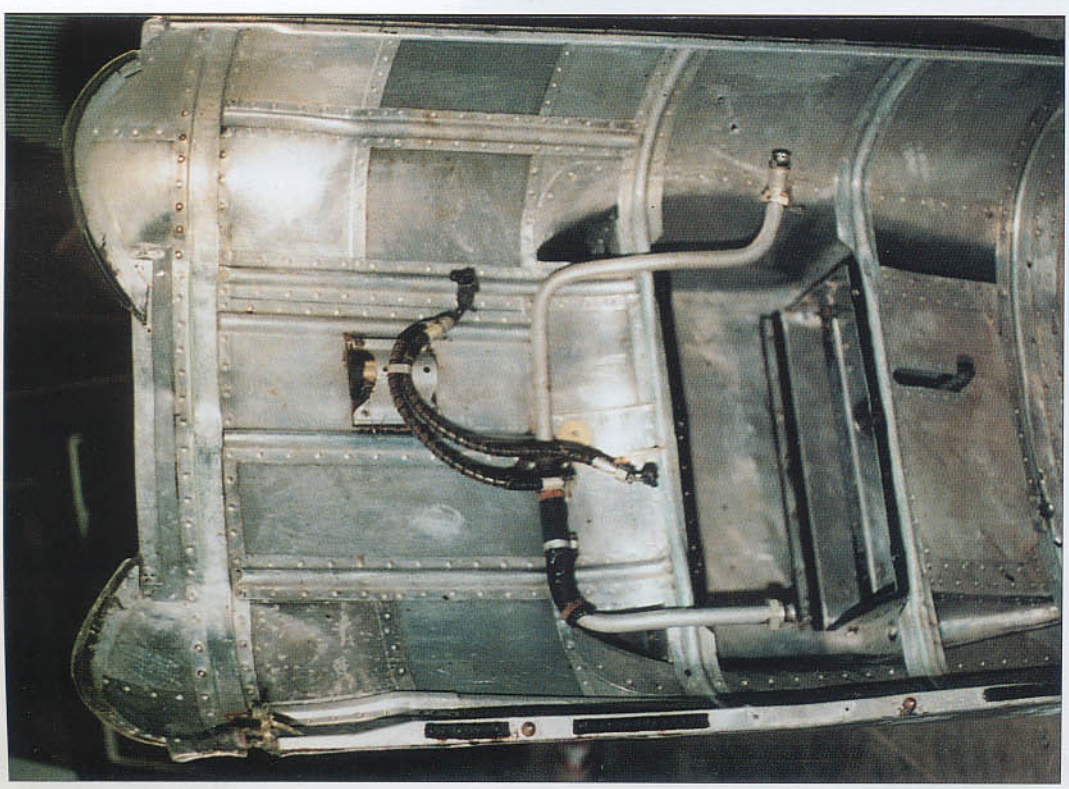
Left: A glimpse through the baggage compartment, located behind the seat, showing the top to the main fuel tank with its filler and pump connectors. The top black colored fitting is the fuel pump while lower black fitting is the contents sender switch.

Right: A view of the rear 29 gal (110 ltr) fuel tank looking forward shows the meticulous attention to detail which characterized this restoration. The red fuel lines (a color favored by American fighters) have since been repainted yellow in keeping with German standards. This beautifully finished blue fuel tank normally held 19.8 gal (75 litre) of MW 50 powerboost (50 percent methanol and 49.5 percent tap water plus 0.5 percent lubricant), or normal C3 aviation fuel of at least 96 octane.



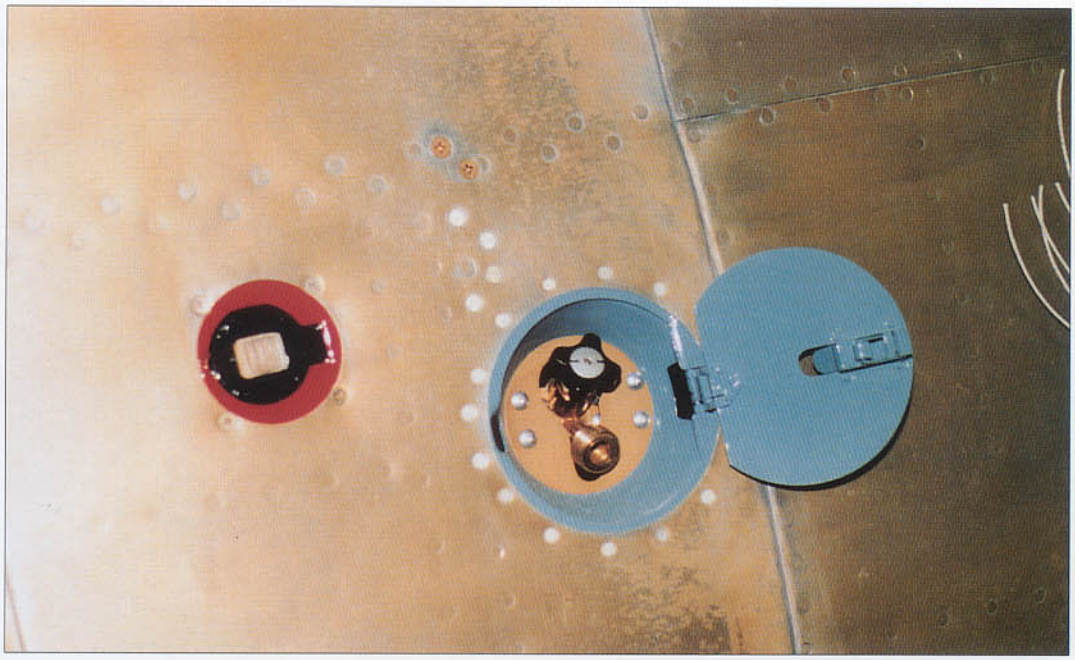
Left: A top view of the port cowl cover showing the compound curve required to clear the enlarged engine bearer arm, and supercharger associated with Messerschmitt fighters equipped with the DB 605 D and AS engines. Note the large hole where the supercharger intake is mounted.

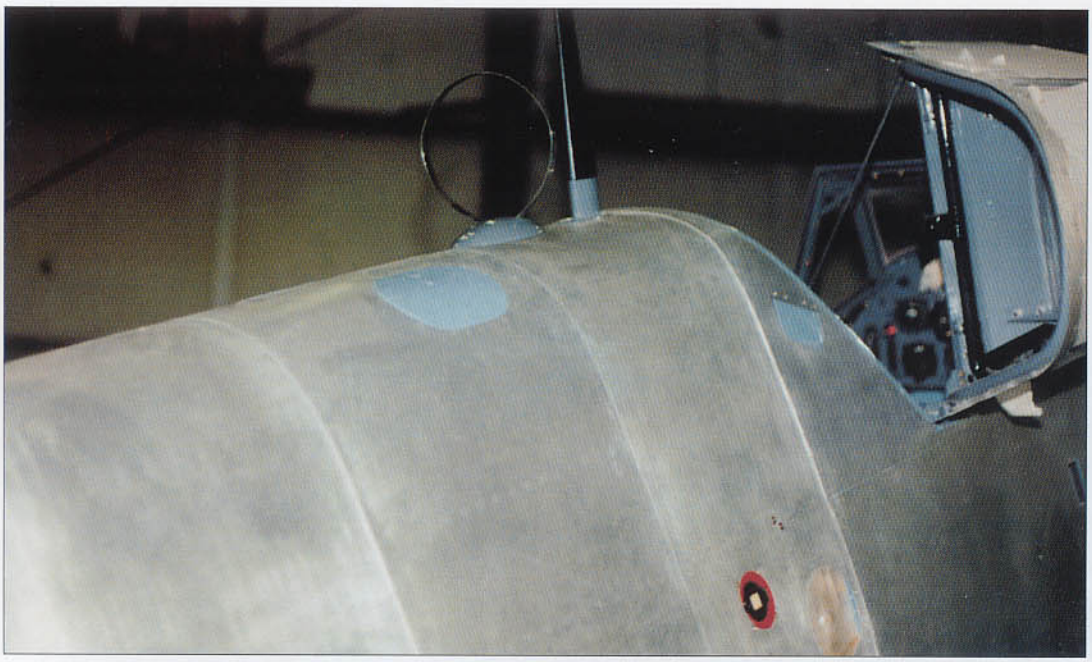
Right: A close-up of the top of the starboard cowl stripped of all paint and ready for final refinishing. Note the elongated opening for the cowl-mounted MG 131 machine gun and the piano hinge running along much of the top centerline.



Left: A view of the inside of the lower cowl showing the two curved bulges at the front which enclosed the enlarged engine camshaft cover and additional oil sump. The chin-mounted radiator hinged on the starboard side, could swing down for easy servicing.

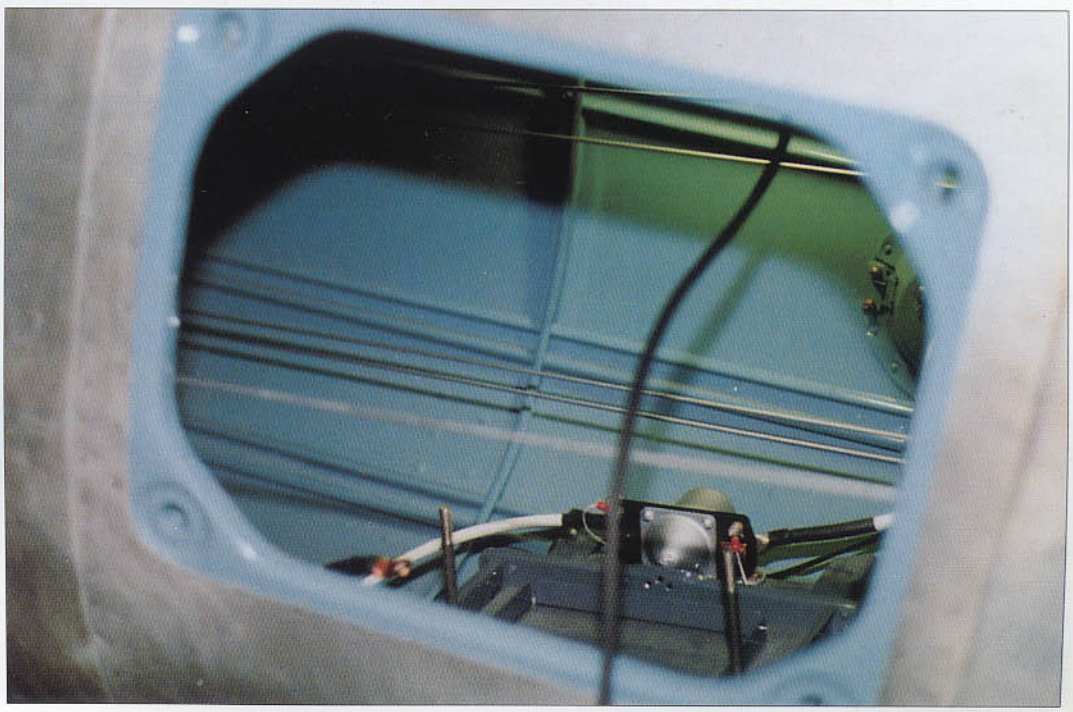
Right: Two external features worth noting on the Evergreen Aviation Messerschmitt are shown in this view of the starboard side of the rear fuselage just aft of the cockpit. The small red circle denotes the 24 volt electrical jack point while the blue area is the location for filling the aircraft oxygen system. Versions of the Bf 109 E, F and G had this arrangement.

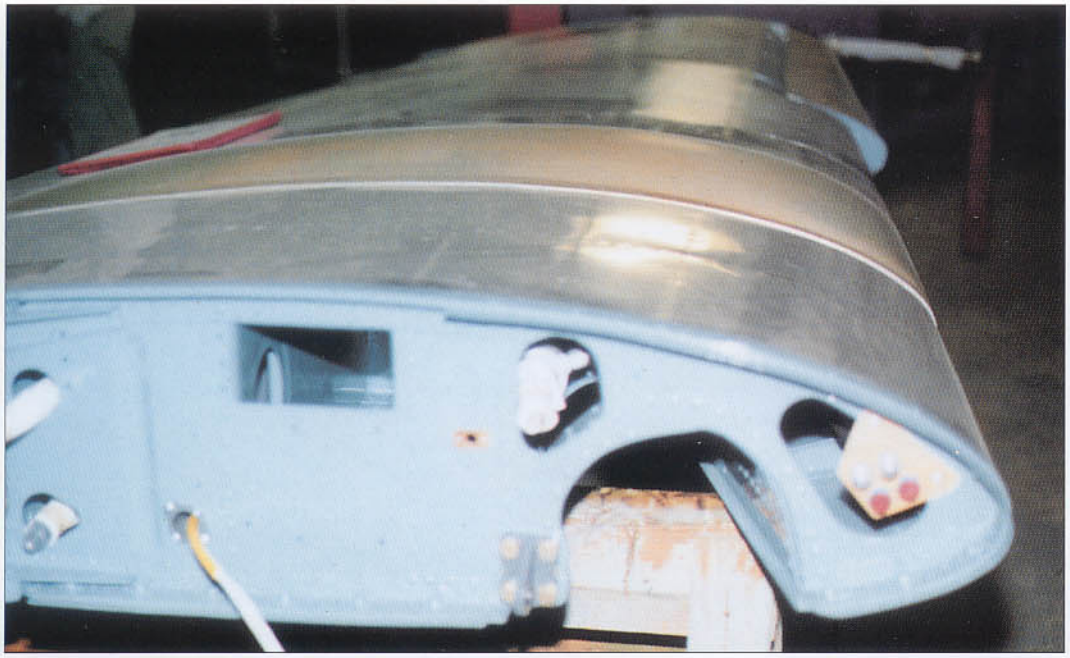




Left: A overall view of the area shown above. The light blue semicircular hatch near the top of the fuselage was the filler point dedicated to the rear fuel tank. An interesting departure from usual German practice was the positioning of the radio mast directly to the fuselage. In reality, almost all German-operated aircraft, which were fitted with the Erla canopy, employed a radio mast attached directly to the top center of the canopy's metal frame.

Right: A glimpse inside the rear fuselage at the point of the port side access hatch showing the master compass mounting base.

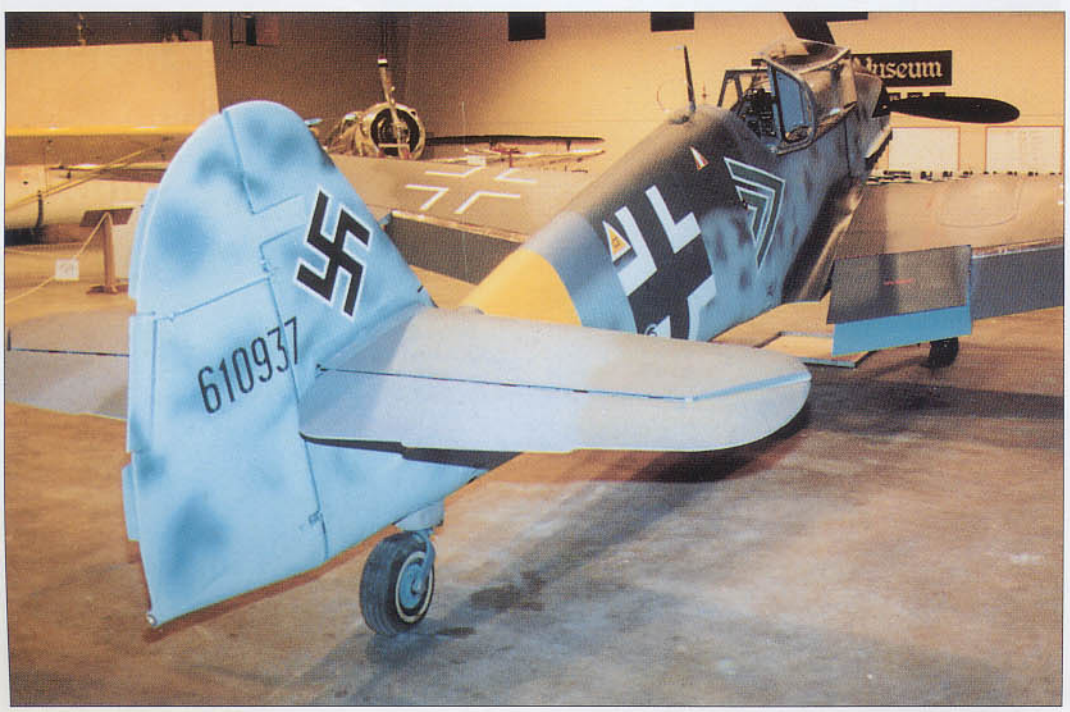




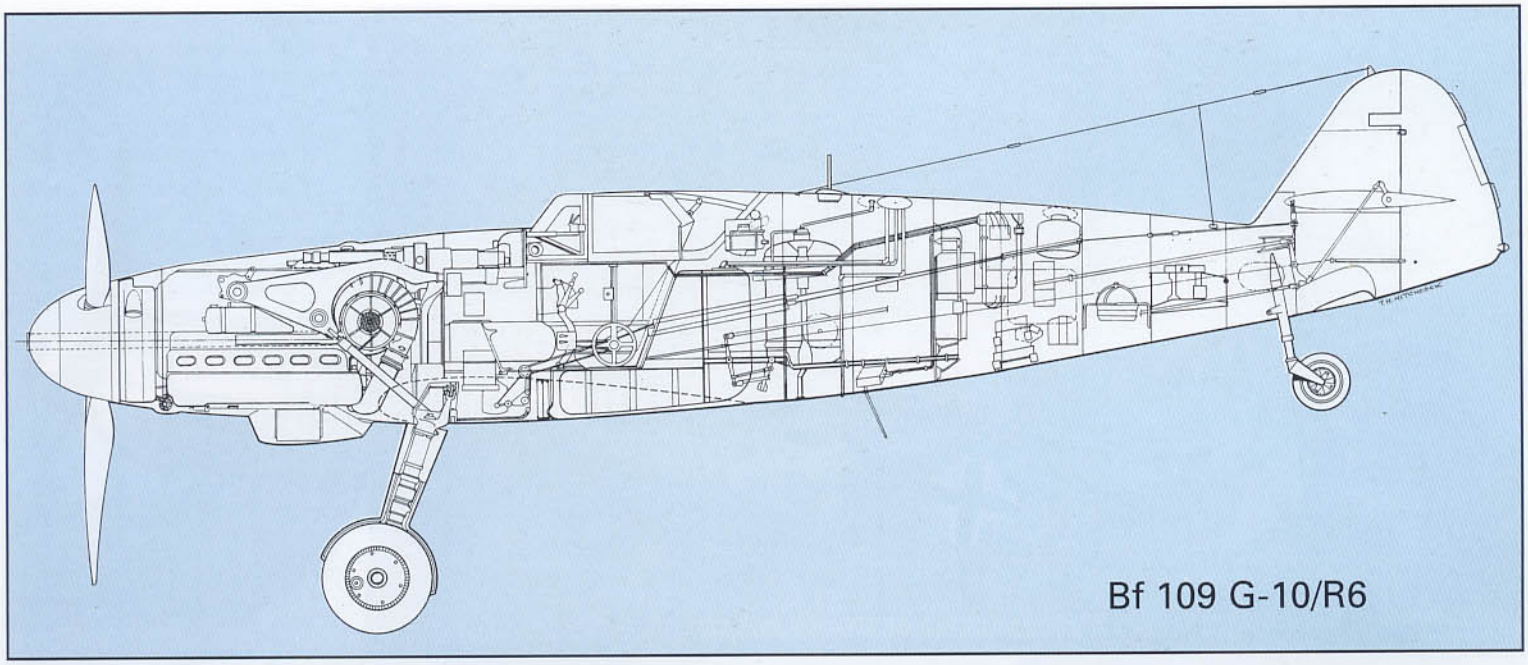
Left: A close-up of the inner section of the port wing at it attachment point showing the cut-out for the landing gear leg and various electrical and mechanical connectors. Of interest is the slightly bulged upper-surface of the wing (painted tan in this view) which was necessitated by the use of tries of much greater size than originally carried by the G-series of fighters. Note too, the rectangular opening which, if the aircraft had been fitted with the standard 20 mm MG 151/20 cannon, would have been the area through which the ammunition was belt-fed from a tray in the port wing.

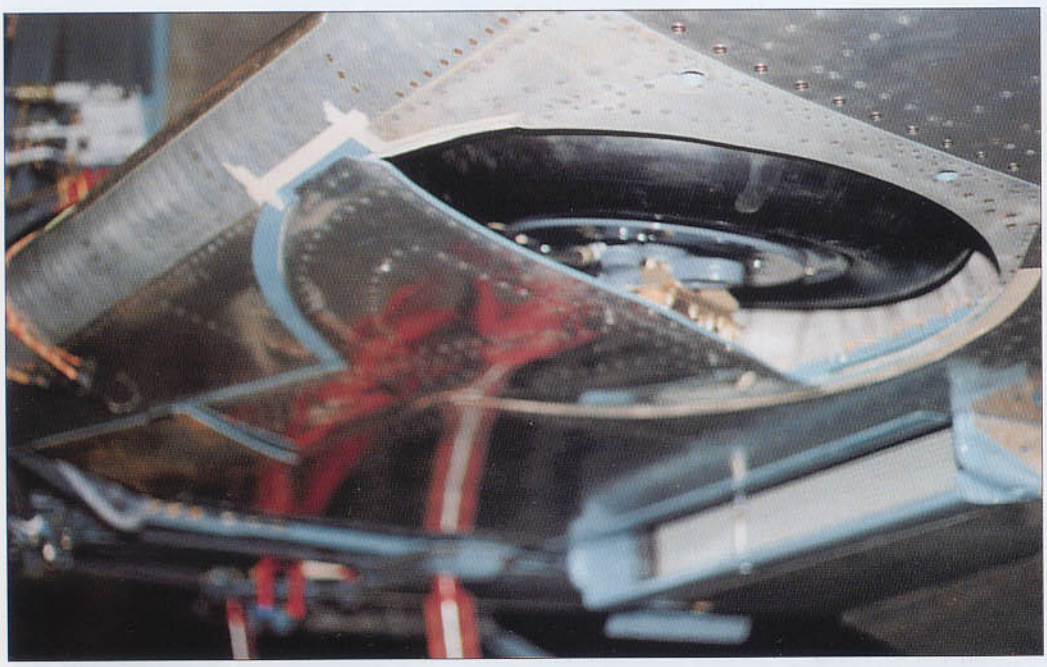
Below left: A close-up of the main wheel with the larger tire size 660 x 190.

Below: An overall view of the main gear with covers in position.



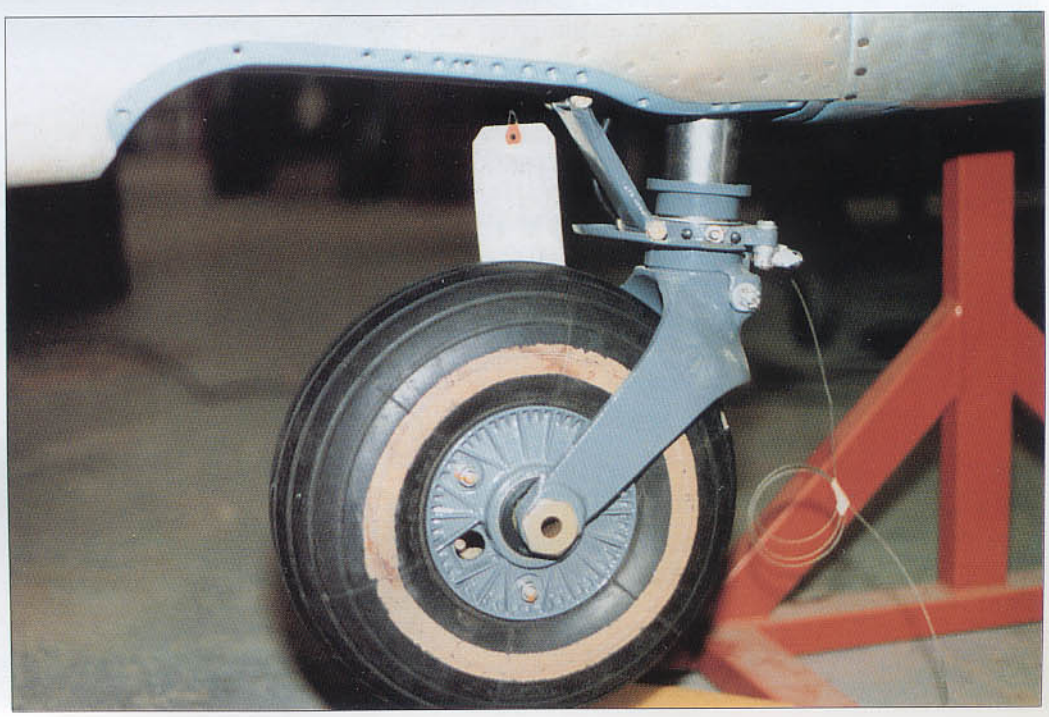
Left: The Bf 109 G-10 series employed several different rudders in combination with two types of tail-wheel legs. Shown here on W.Nr. 610937, is the model 8-009.320 rudder assembly in conjunction with the standard short tail wheel leg. This rudder is characterized by having the fully adjustable Flettner trim tab located about mid way along the trailing edge supplemented by two additional tabs which were only adjustable on the ground. This rudder model was common to the three Bf 109 G-10/U4s brought to the United States, in which each was also equipped with the MK 108 engine-mounted cannon.





Left: Messerschmitt had originally planned to install wheel well doors on the G-series, but apart from a handful of test aircraft, this plan was shelved (the K-series reinstated the covers). This view of W.Nr. 610 937 shows the port wheel well area and the non-standard filler added to the lower surface of the wing. This addition to the wing made the opening entirely circular in the same manner as was found on Bf 109 F-4s.

Right: A close-up of the tail wheel assembly for Bf 109 G-10/U4, W.Nr. 610937, showing the white wall tire, size 350x135. Although the tailwheel was retractable in the F-series, the G-series abandoned this feature. An extra cover plate was added thus sealing the opening.



Focke-Wulf Ta 152 H-0 / H-1

The first of twenty preproduction Ta 152 H-0s, produced by Focke-Wulf's Cottbus facility, appeared in October, 1944, and was immediately issued to *Erprobungskommando Ta 152* at Rechlin for service testing. Conceived as a high altitude fighter originating from a May 20, 1942 Air Ministry requirement for a *Spezial Höhenjäger* (Special high altitude fighter), jointly issued to Focke-Wulf and Messerschmitt, the development of this thoroughbred was neither rapid nor smooth in spite of the fact it was broadly based on the highly successful Fw 190.

Powered by a Junkers Jumo 213 E-1 developing 1,750 hp for takeoff, and driving a wooden three-bladed Junkers VS 9 propeller, with a take-off weight of 11,501 lb (5,217 kg), the Ta 152 H-1 was capable of reaching 467 mph at 40,000 feet (752 km/h at 12.4 km). Armament consisted of one engine-mounted 30 mm MK 108 cannon with 85 to 100 rounds, plus two 20 mm MG 151/20 cannons at the wing root position, each with 175 rounds.

Since the fighter was expected to perform and maneuver at high altitude, the long span wing was designed to ensure that airflow separation at high angles of attack did not occur at once over the entire wing. To achieve this, the wing was designed with a $2^1/_2$ to 3 degree negative twist from the wing root trailing edge outboard to the flap-aileron junction. Since the aileron's angle was less, airflow separation was delayed, thereby enabling prolonged control during combat conditions.

By the end of 1944, flight testing of the Ta 152 H-0s revealed a considerable number of problems, several of which were of major concern. No sooner was one condition corrected, than another revealed itself. The most troublesome to correct was the cabin pressurization system. Eventually, this too, was made to work more-or-less as designed.

In January, 1945, the first examples of the Ta 152 H-1 began leaving the Cottbus factory. These were similar to the preproduction H-0s, apart from having additional fuel tanks in the wings. Five tanks carried B4 aviation fuel, plus one (left inboard) for MW 50 powerboost. Another fuel tank mounted in the aft fuselage contained $22^1/_2$ gal (85 ltr) of GM 1 powerboost.

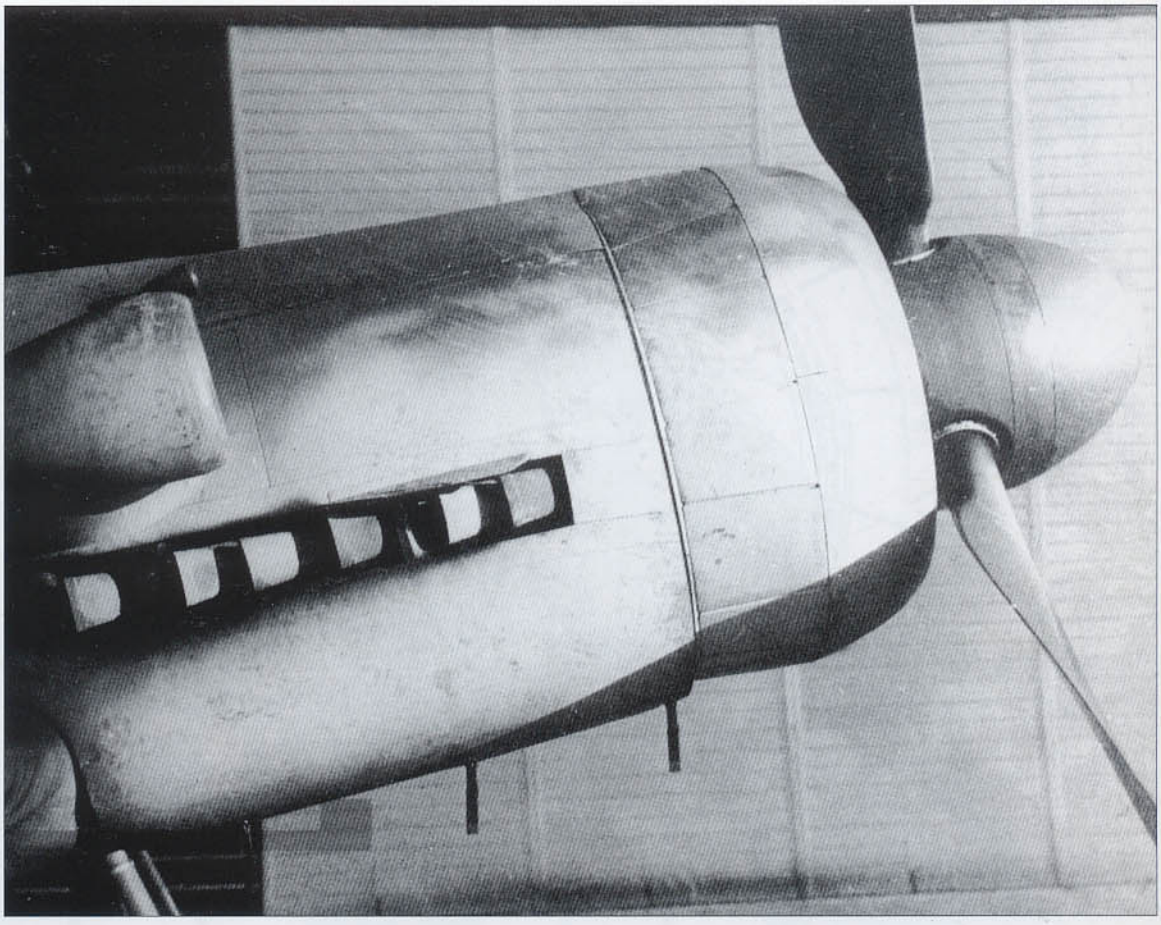
In spite of the success rate the *Luftwaffe* was experiencing in trying to bring the Ta 152 H-1 to a point of reliability, many aircraft were grounded due to parts shortages. As the area under German control continually shrank, so too did the all-important distribution network. However, those aircraft which were cleared for operations did not disappoint their pilots. Indeed, the new fighter was clearly a dynamic performer, and in the hands of a skilled pilot, it proved it was more than a match for the Allied fighters which opposed it.

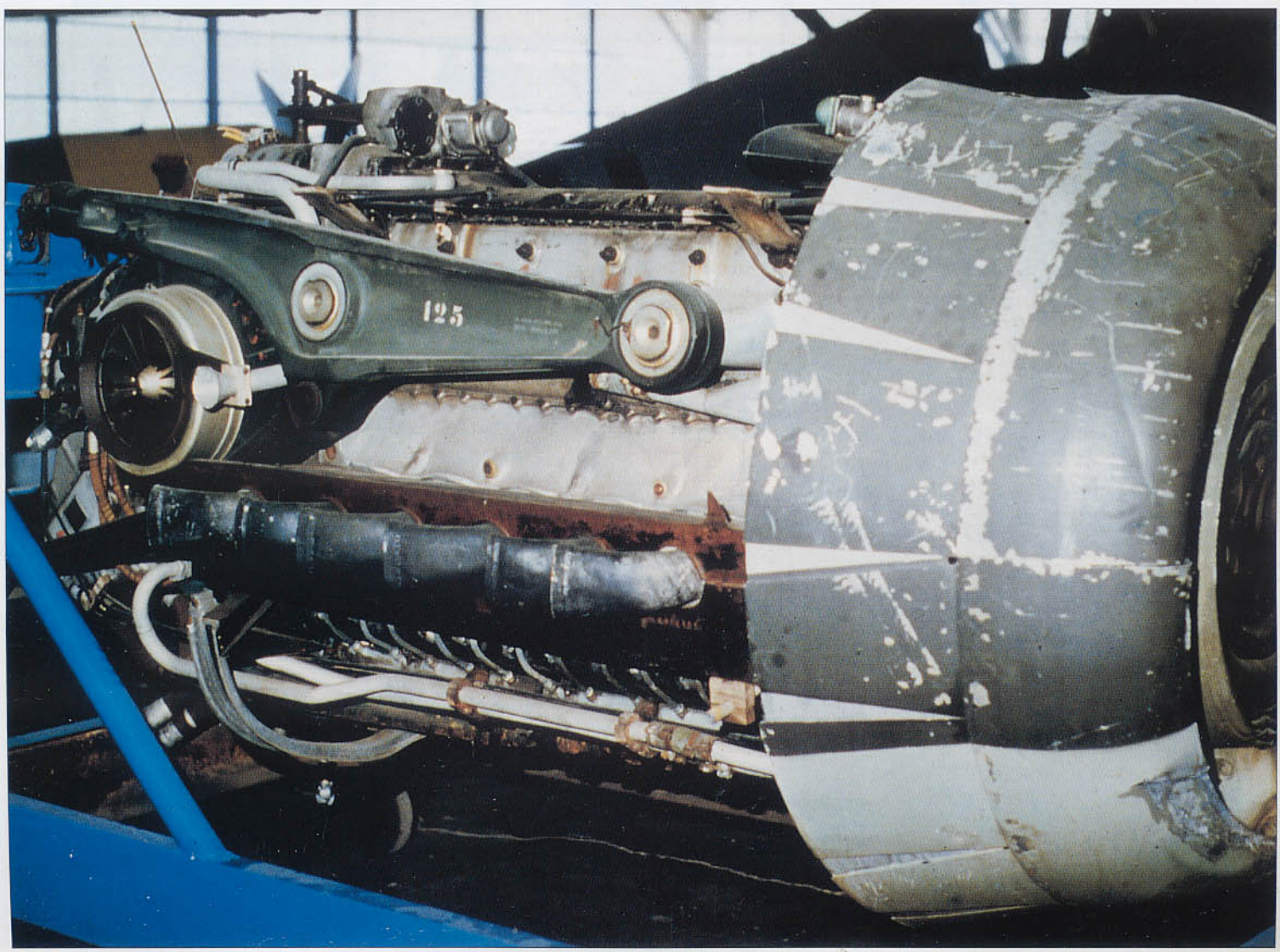
By February 1945, when the last Ta 152 was completed, total production amounted to only 67 aircraft, with almost all of them Ta 152 H-0s and H-1s.

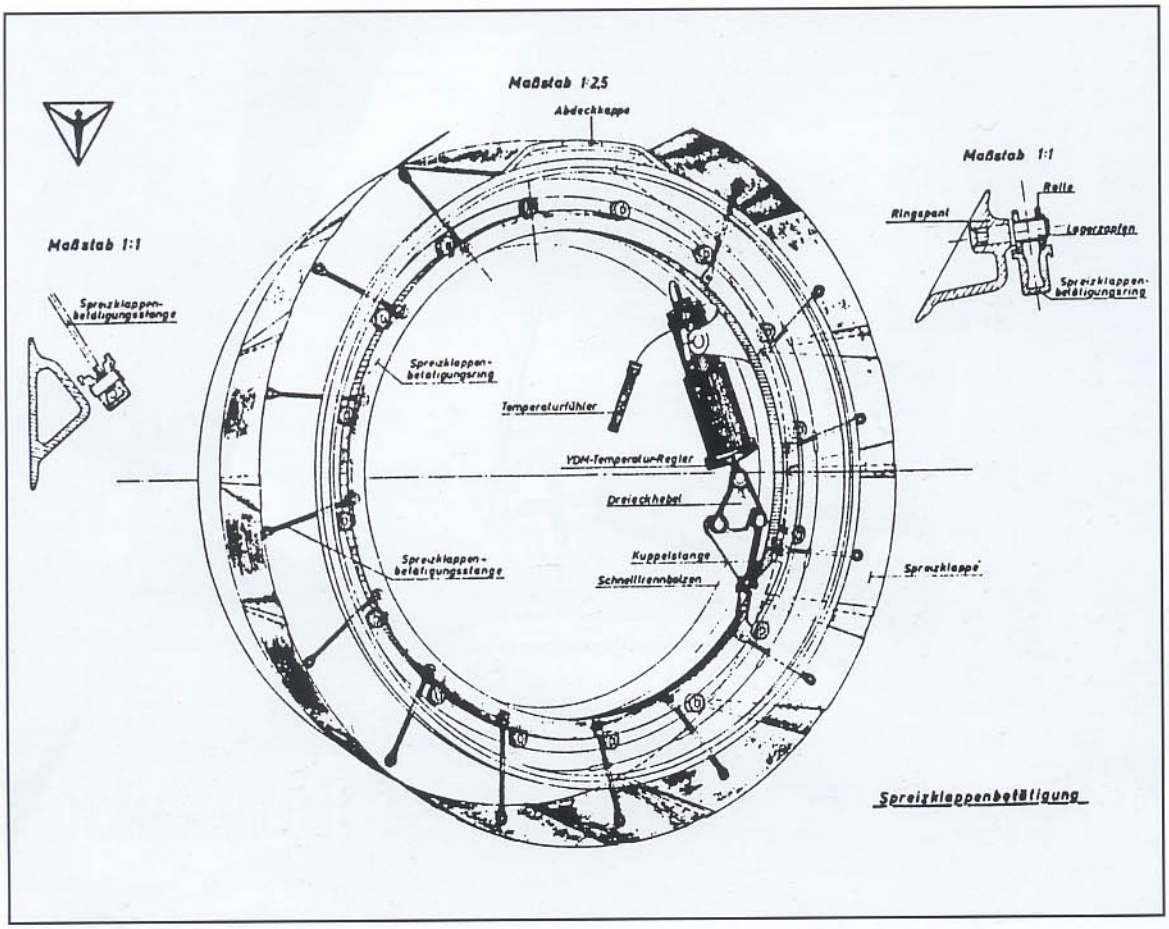
Above: Ta 152 H-0, believed to be W.Nr. 150010, CW+CJ, green 4, flown by *Ofw.* Walter Loos formerly of the *Stab*/JG 301, photographed in October 1945 at Wright Field as Foreign Equipment FE-112. This example was captured intact by British forces at Tirstrup, Denmark, before being handed over to Col. Watson for transfer to the United States. The aircraft is currently in storage for the National Air and Space Museum. Several postwar sources claim this aircraft's serial number is 150003, but there is no evidence to support this conclusion.

Right: A close-up of the starboard side of the nose of Fw 190 V30/U1, W.Nr. 0055, GH+KT, a development prototype for the Ta 152 H program.

Below: An excellent detail shot of the starboard side of a Jumo 213 E-1 together with its forward cowling showing the engine bearer arm to advantage. It is possible that this engine originally was fitted to Ta 152 H-1, W.Nr. 150167.



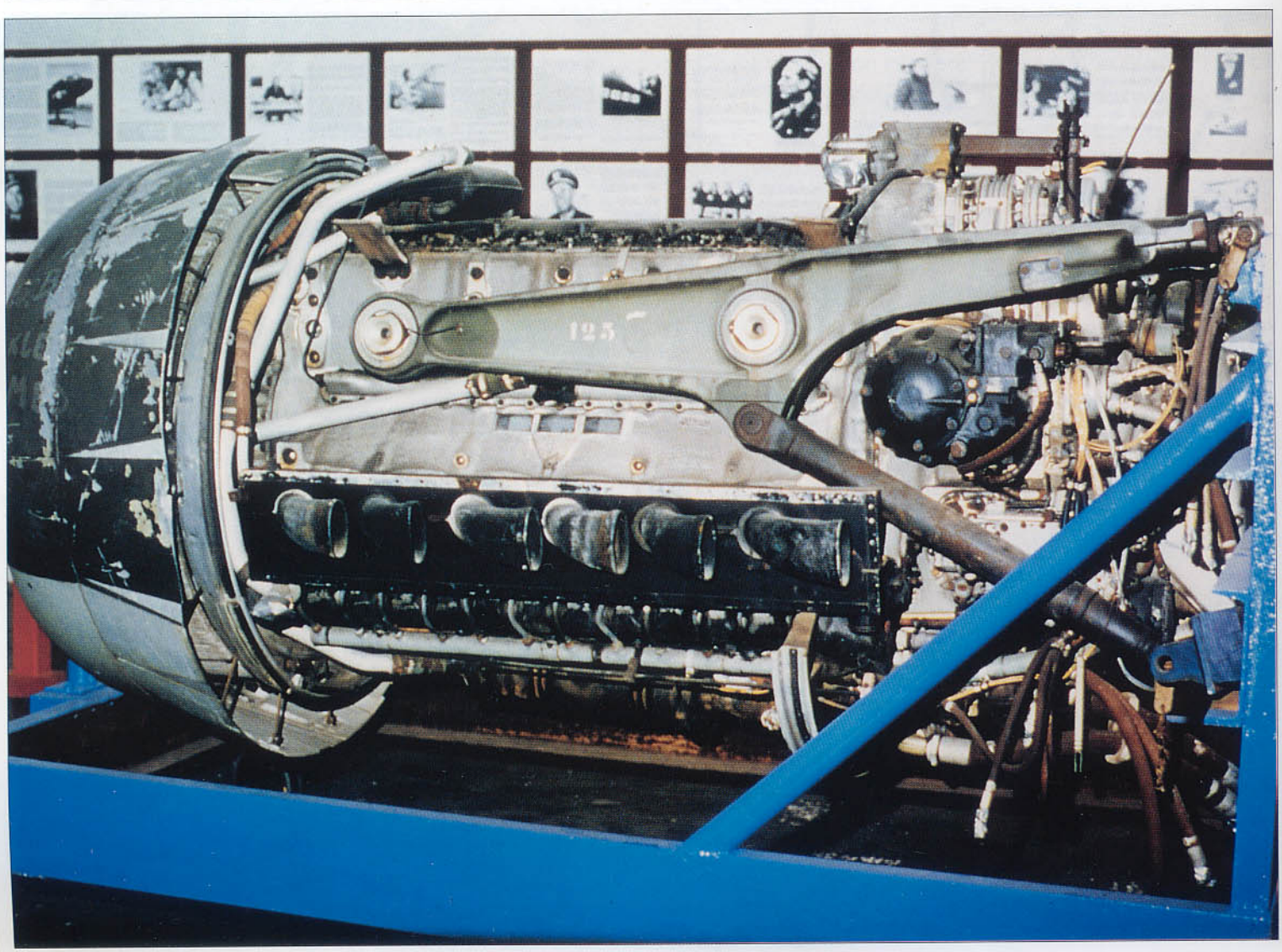


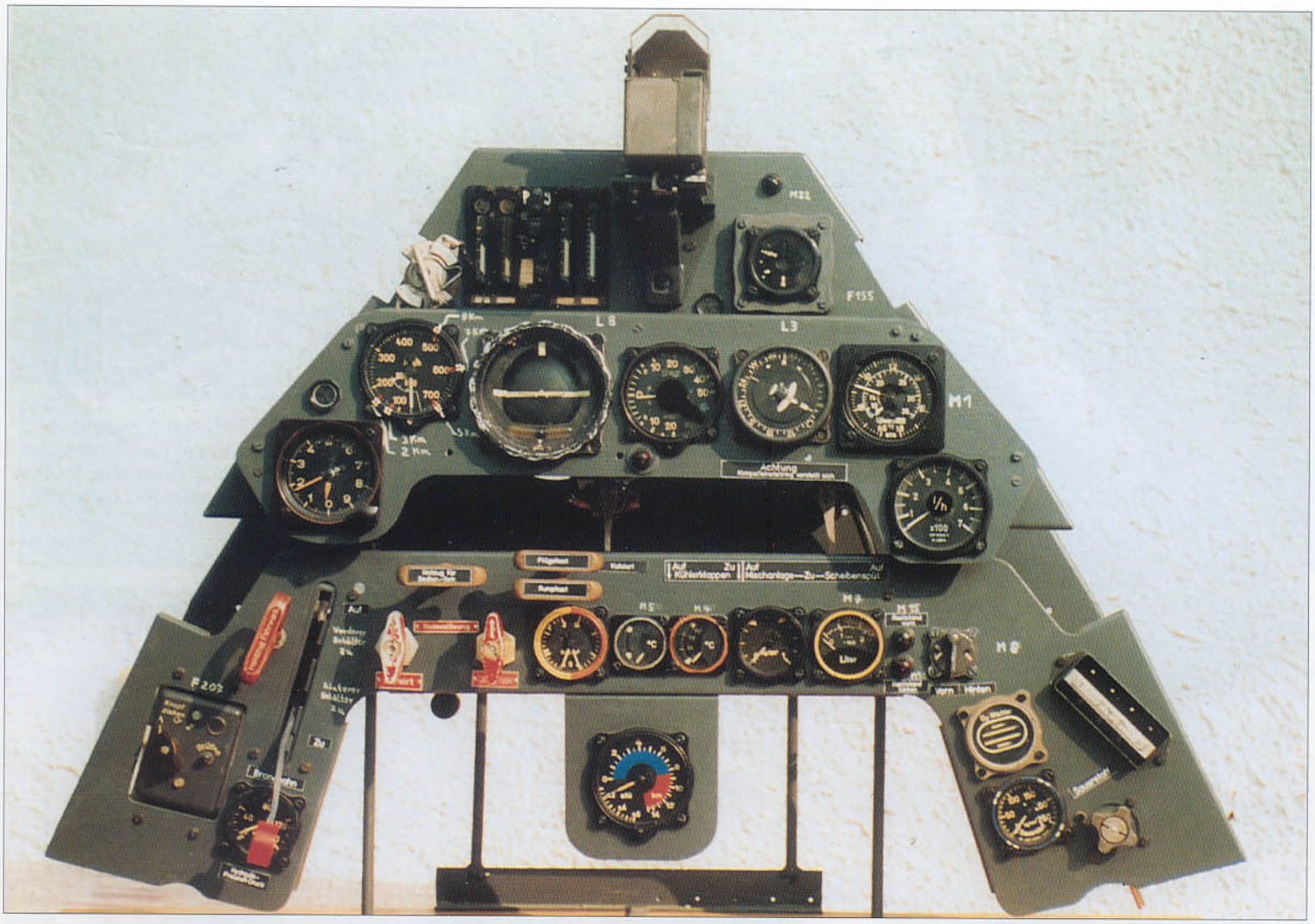


Left: A detail drawing of the forward cowling of a Ta 152 H-0/H-1 showing the layout of the engine's cooling gills.

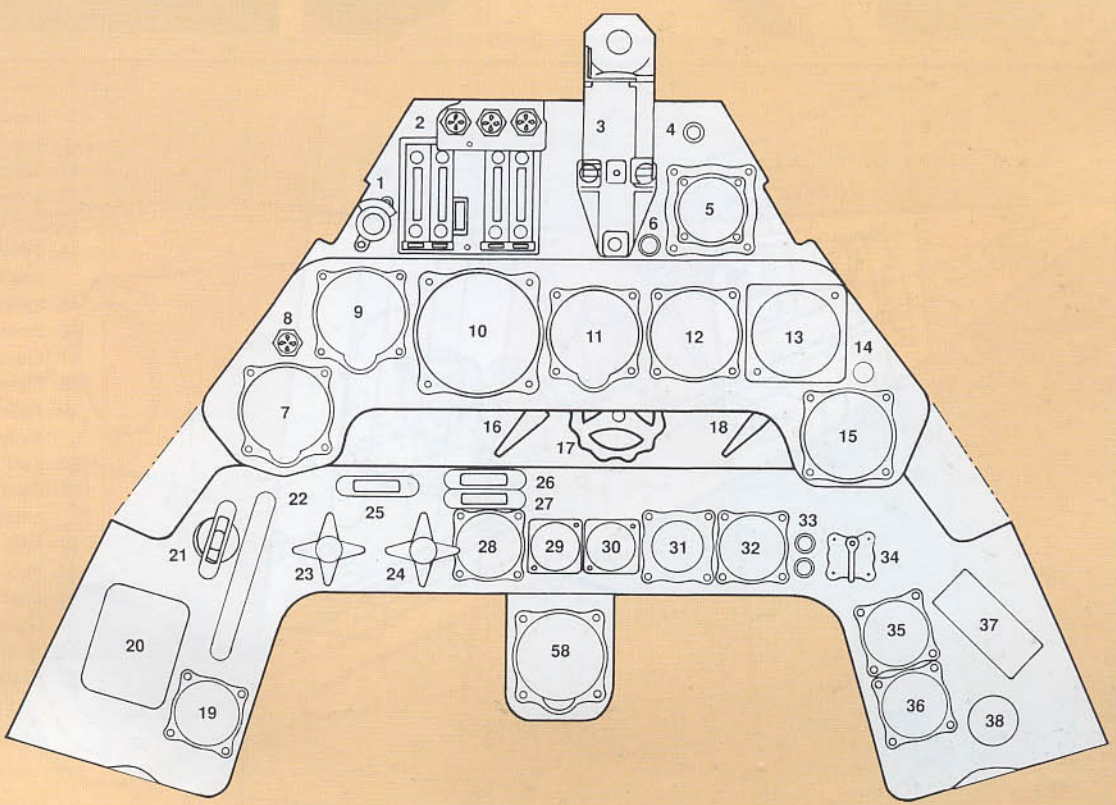
Below: An overall view of the port side of the Jumo 213 E-1 shown on the preceding page. The Jumo 213 E was a 2,136 cu in (35 litre) liquid-cooled inverted V-12, similar to the earlier Jumo 213 A, but fitted with a three-speed two-stage supercharger and induction cooler. It developed 1,750 hp at 3,200 rpm for take off and drove an 11 ft $9^{3}/_{4}$ in (3,600 mm) diameter wooden three-bladed VS 9 propeller

Right opposite: A beautifully restored Ta 152 H-1 instrument panel showing the correct instrumentation and panel coloring.

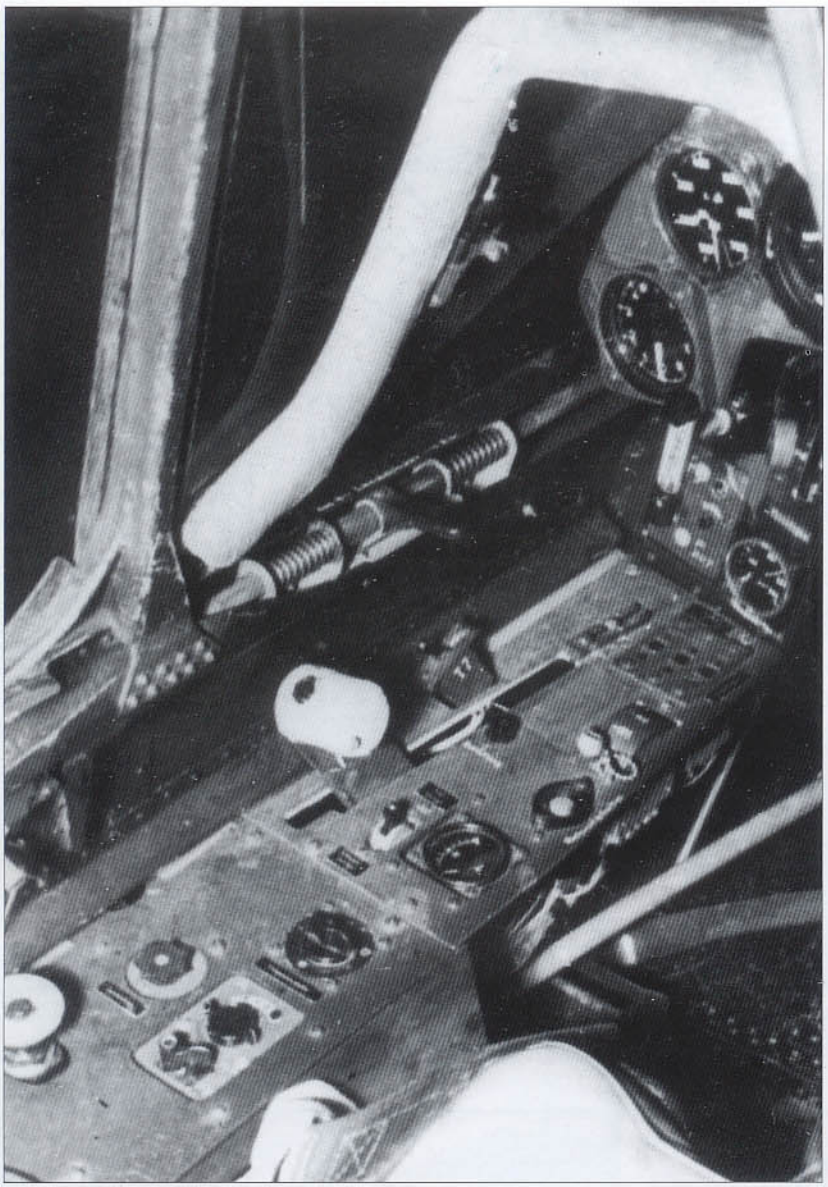


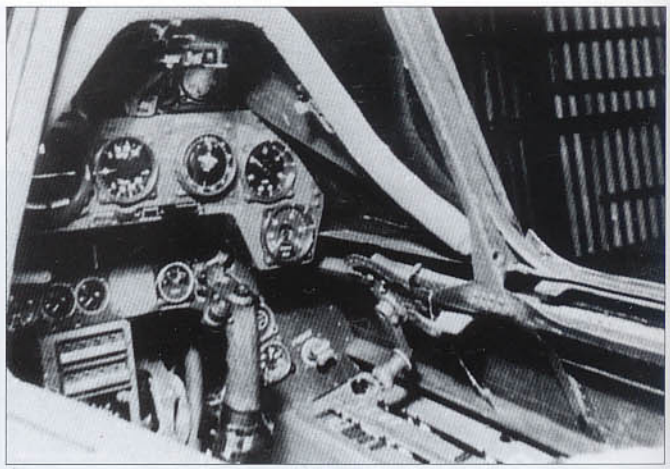


1. MK 108 cannon button
2. Ammunition switch and round counters
3. Revi gunsight
4. Altitude warning lamp
5. AFN 2 homing device
6. Cabin ventilation switch
7. Altimeter
8. Pitot tube heater indicator lamp
9. Airspeed indicator
10. Artificial horizon + turn and bank indicator
11. Variometer
12. Repeater compass
13. Manifold boost pressure gauge
14. MW 50 warning lamp
15. Fuel comsumption gauge
16. Cold start switch
17. Radiator flap regulator
18. Windscreen rinsing switch
19. Hydraulic pressure gauge
20. FuG 25a radio unit
21. Landing gear switch
22. Fire safety pet cock
23. Emergency gear lowering
24. Emergency landing flap lowering
25. Emergency pull for engine control unit
26. Pull for releasing wing ordnance
27. Pull for releasing fuselage ordnance
28. Fuel + oil pressure gauge
29. Coolant temperature gauge
30. Oil temperature gauge
31. Variometer (only for DB 603 engine)
32. Fuel contents gauge
33. Low fuel warning lamps
34. Fuel change-over switch
35. Oxygen indicator
36. Oxygen pressure gauge
37. Signal flare pistol pressure head box
38. Oxygen vent valve
58. Cabin pressurization gauge

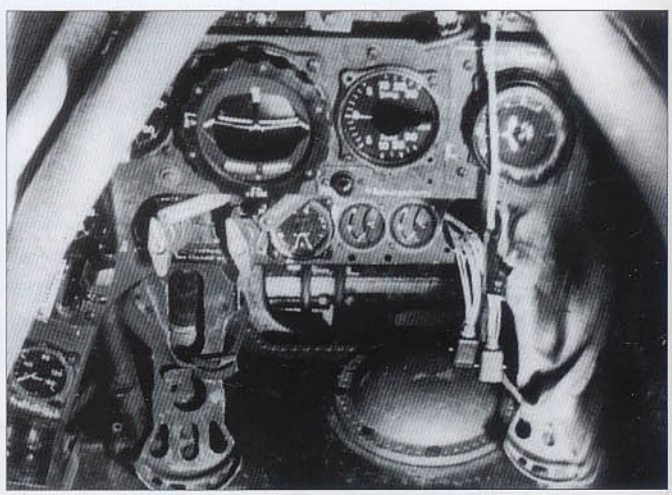


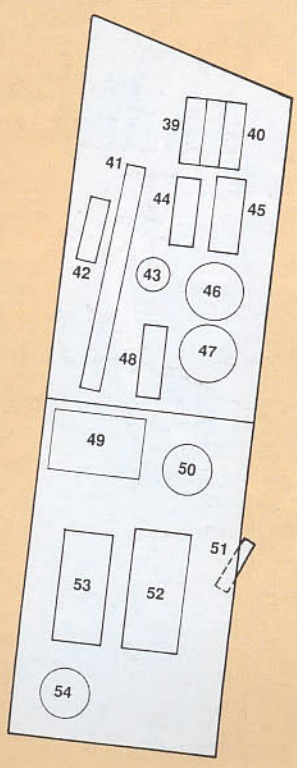
Ta 152 H-0/H-1 Instrument Panel



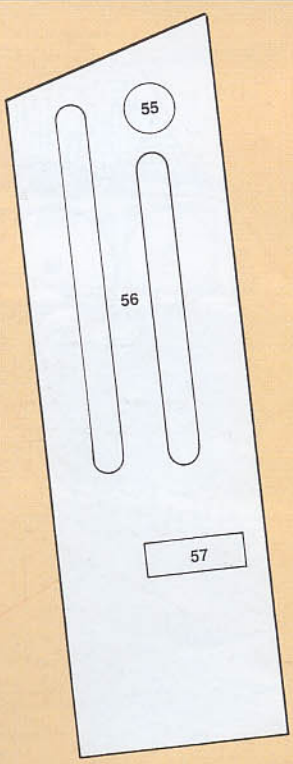


This page: Three view of the Ta 152 H-0/H-1 cockpit. In spite of considerable experience with the Fw 190, Focke-Wulf's placement of engine and flight instruments for the Ta 152 H came under criticism by experienced *Luftwaffe* pilots.



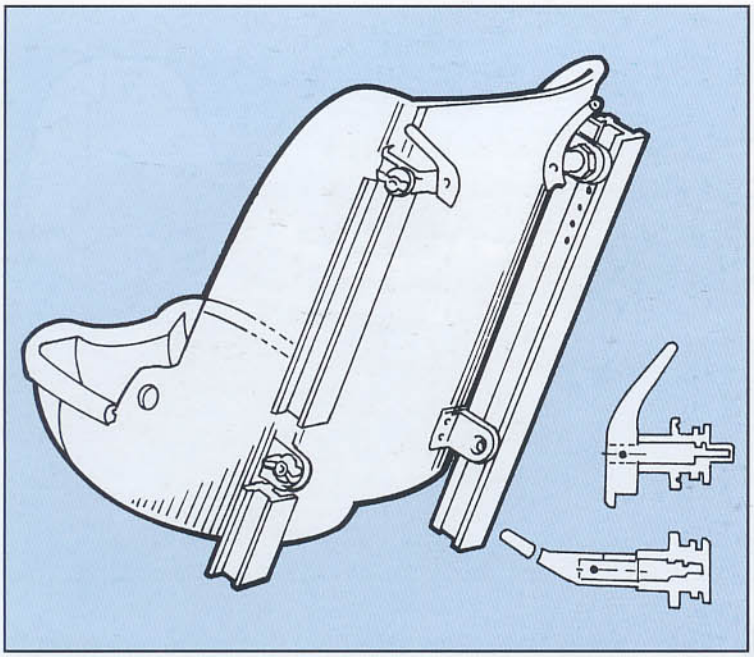


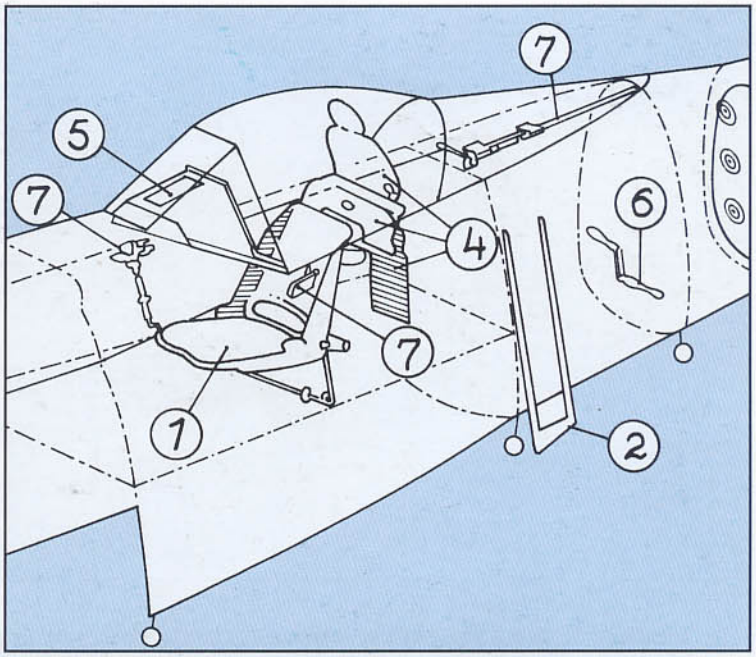
Left Console

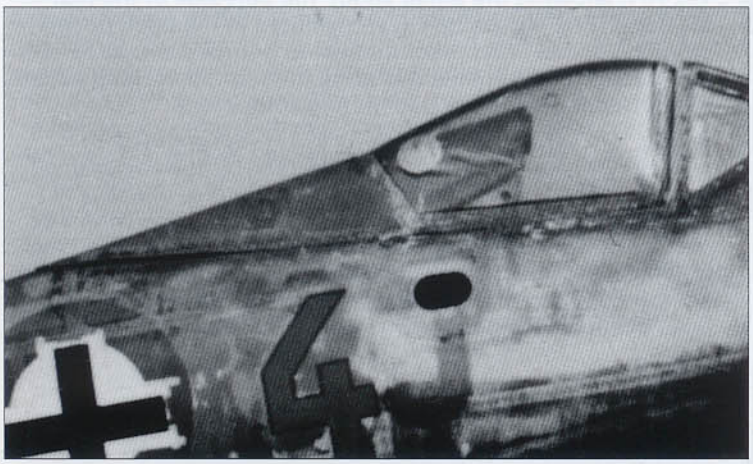


Right Console

39. Landing gear position indicator
40. Flap position indicator
41. Throttle lever
42. Emergency circuit breaker
43. GM 1 deaerating control
44. Selector switch for special fuel system (not fitted on H-0 aircraft)
45. Ignition switch
46. Emergency circuit breaker
47. Elevator trip indicator
48. Elevator trim switch
49. FuG 125 remote control (only for H-1/R11 aircraft)
50. FuG 16 ZY operating switch
51. Connection for pilots electrically heated suit
52. FuG 16 ZY socket connection
53. FuG 16 ZY remote control
54. Engine priming pump handle
55. Black-out control
56. Automatic switches
57. Starter switch



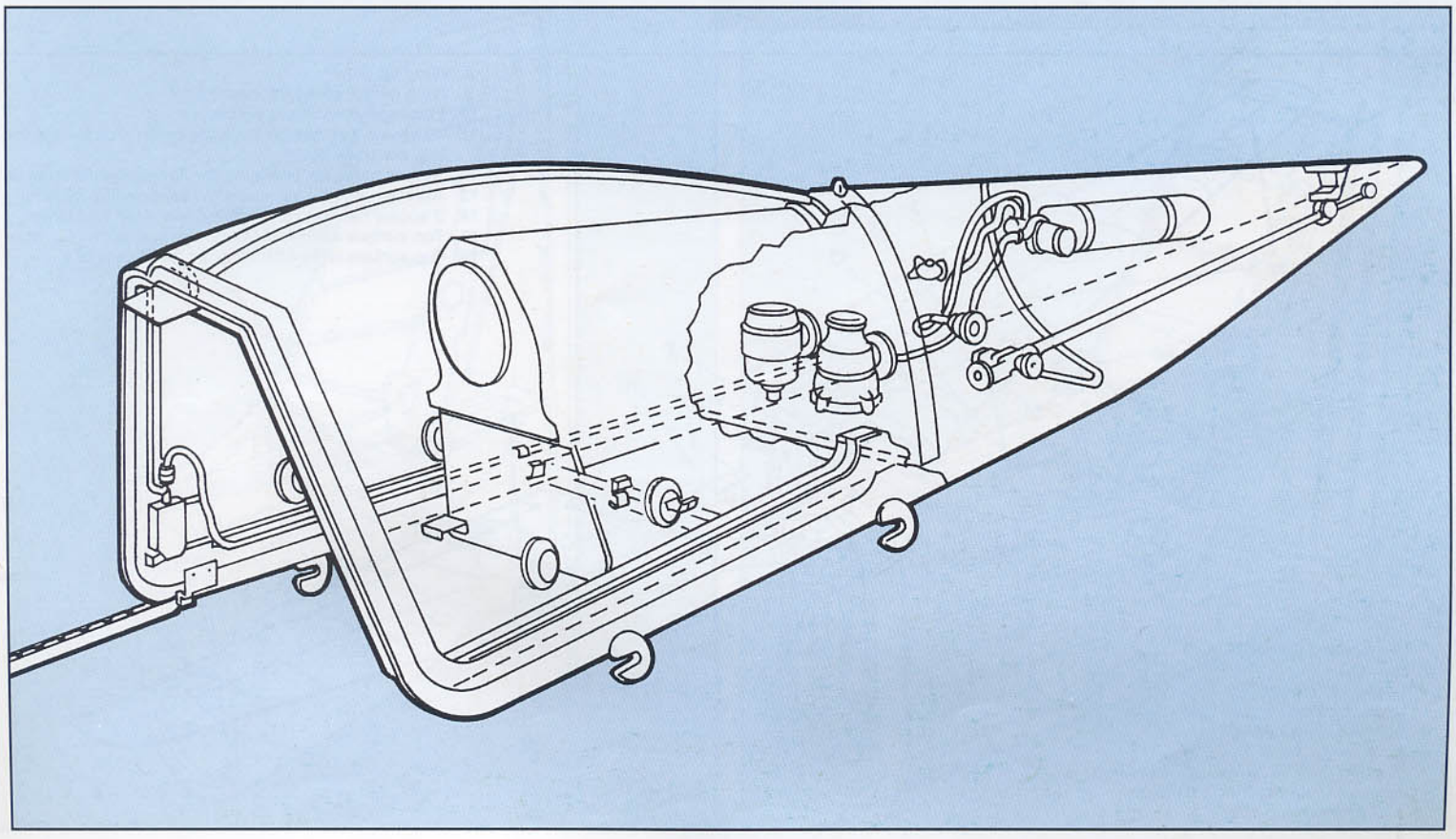


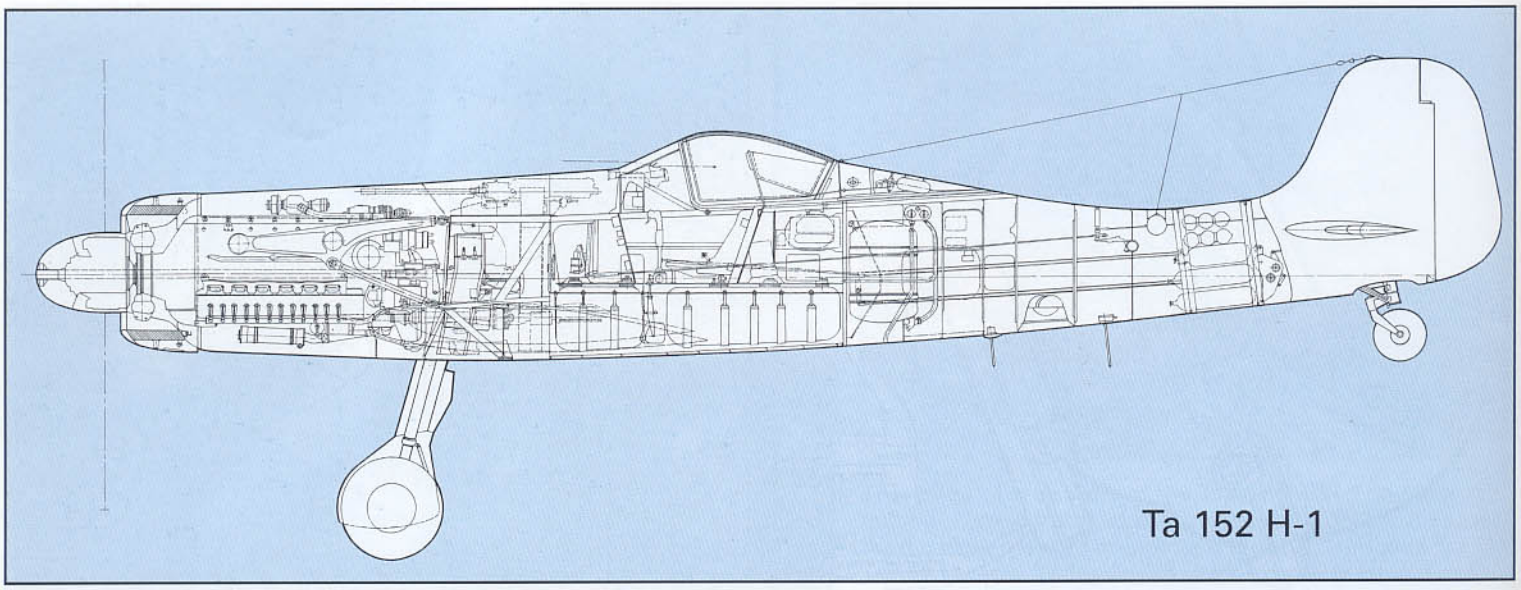


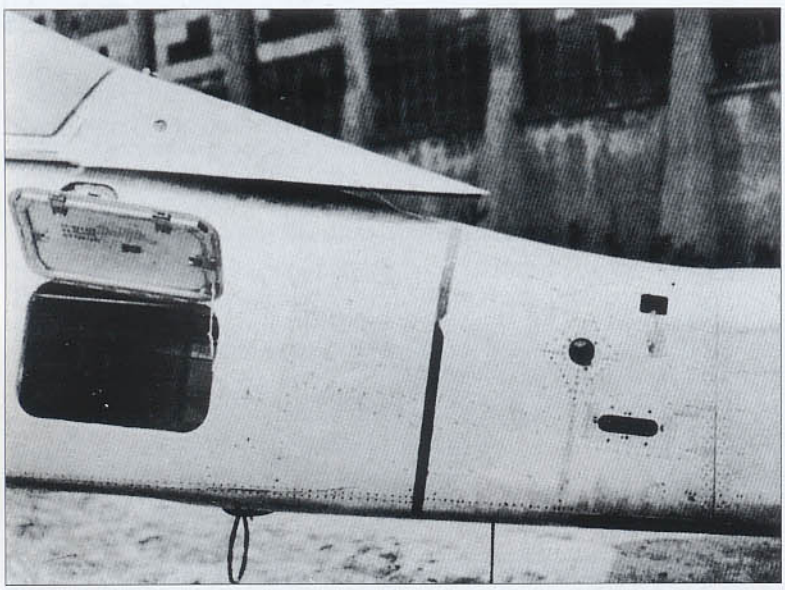
Above: Two views of the interior features of the cockpit showing the pilot's armored seat (left) and the placement of various other components (right) including armor plating and the retractable foot step. It is interesting to note that many of these components were common to the Fw 190 A-8 (see p. 148).

Left: A close-up of the Ta 152 H-0 canopy showing the head armor and double wall canopy glass.

Below: Focke-Wulf had great difficulty trying to perfect their cockpit pressurization and, for the most part,without a great deal of success. Shown here are the various components to the double wall canopy with their locking lugs and pressurization equipment.

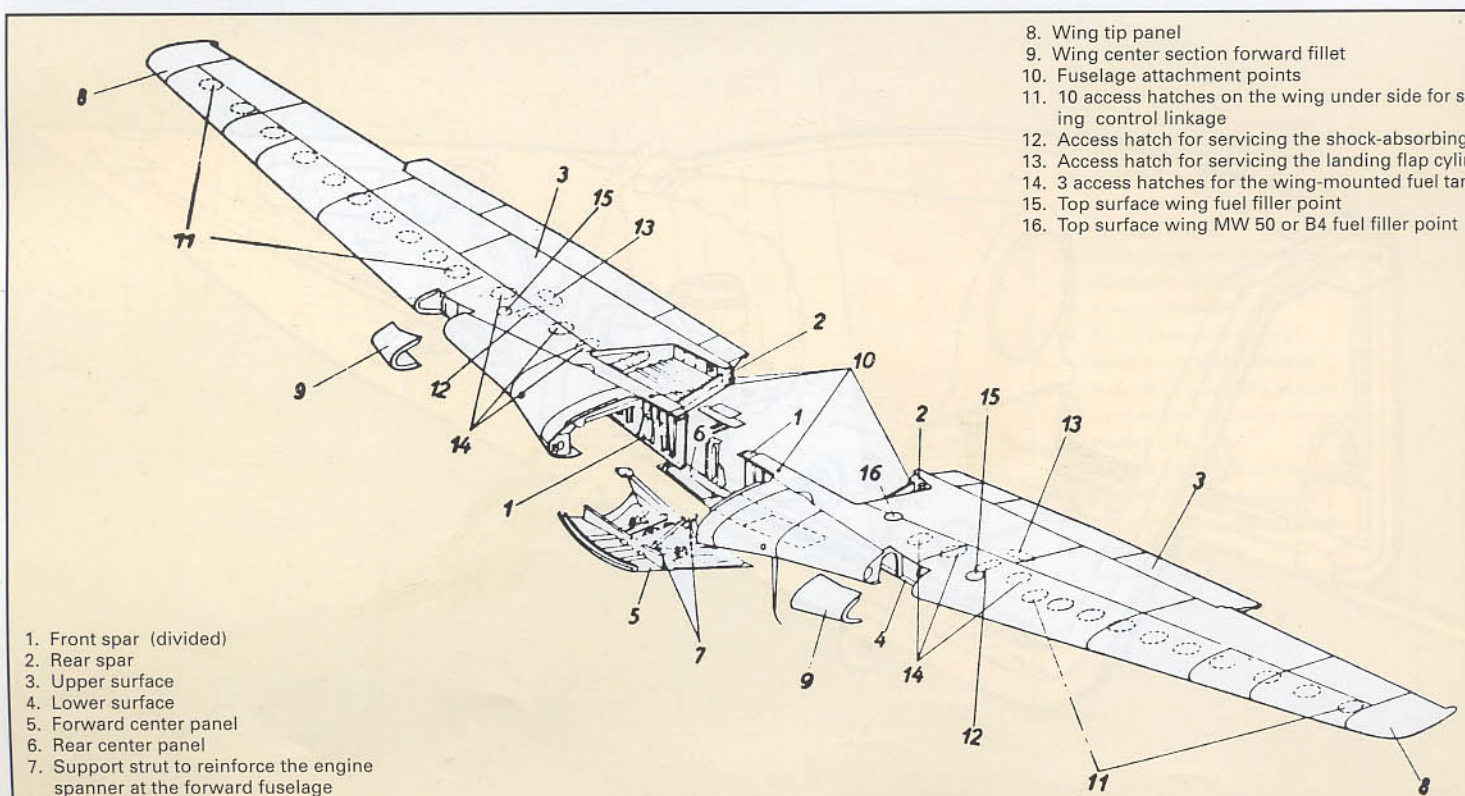




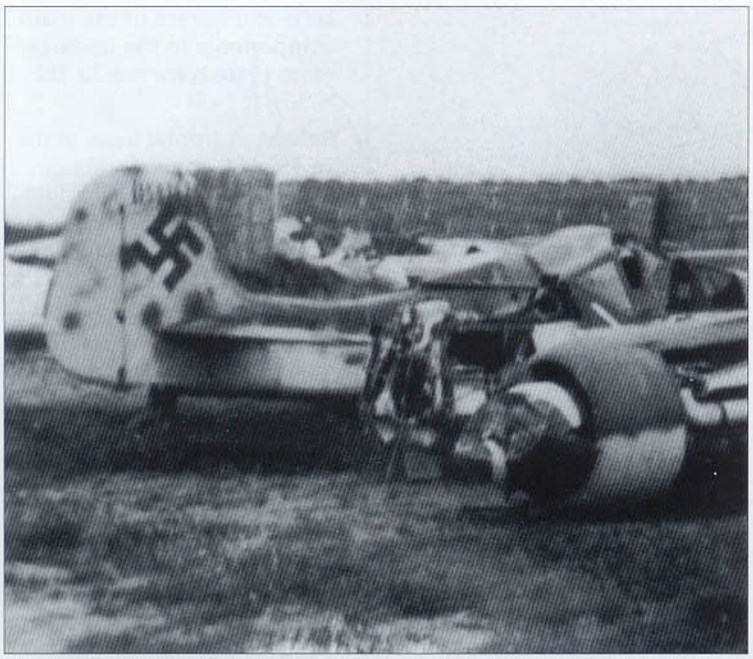


Left: A view of one of the early production examples of the Ta 152 H-1, showing the detail about the port side of the rear fuselage. The access hatch, shown here in the open position, could be made of wood or metal and afforded access to several interior components including the rear fuselage fuel tank, radio, homing and direction finding equipment.

Below: The wing design of the Ta 152 H was engineered for high performance and high maneuverability. It was designed to ensure that airflow separation at high angles of attack did not occur at once over the entire wing. Instead, the wing was designed with a 2 - 3 degree negative twist from the wing root trailing edge outboard to the flap aileron junction. Because the aileron's angle was less, airflow separation was delayed thereby enabling prolonged control during all flight conditions.

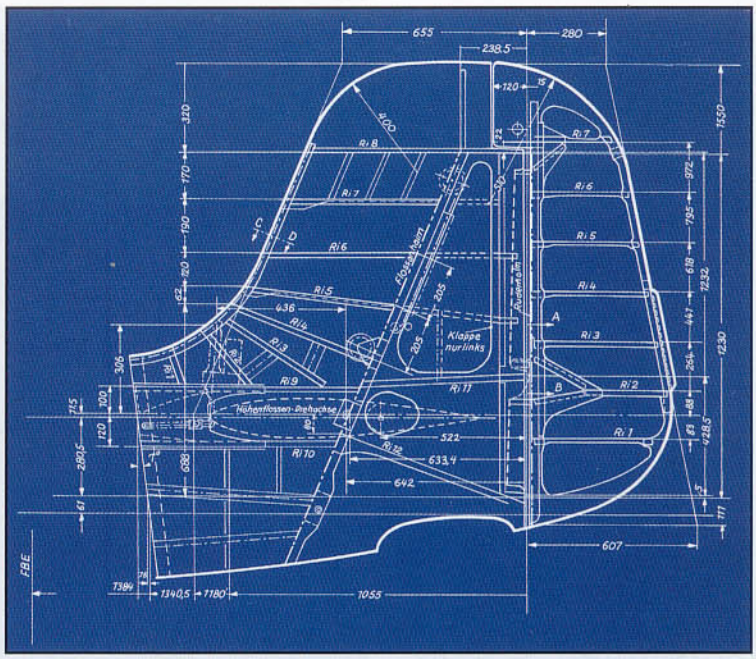


1. Front spar (divided)
2. Rear spar
3. Upper surface
4. Lower surface
5. Forward center panel
6. Rear center panel
7. Support strut to reinforce the engine spanner at the forward fuselage against the main spar
8. Wing tip panel
9. Wing center section forward fillet
10. Fuselage attachment points
11. 10 access hatches on the wing under side for servicing control linkage
12. Access hatch for servicing the shock-absorbing strut
13. Access hatch for servicing the landing flap cylinder
14. 3 access hatches for the wing-mounted fuel tanks
15. Top surface wing fuel filler point
16. Top surface wing MW 50 or B4 fuel filler point



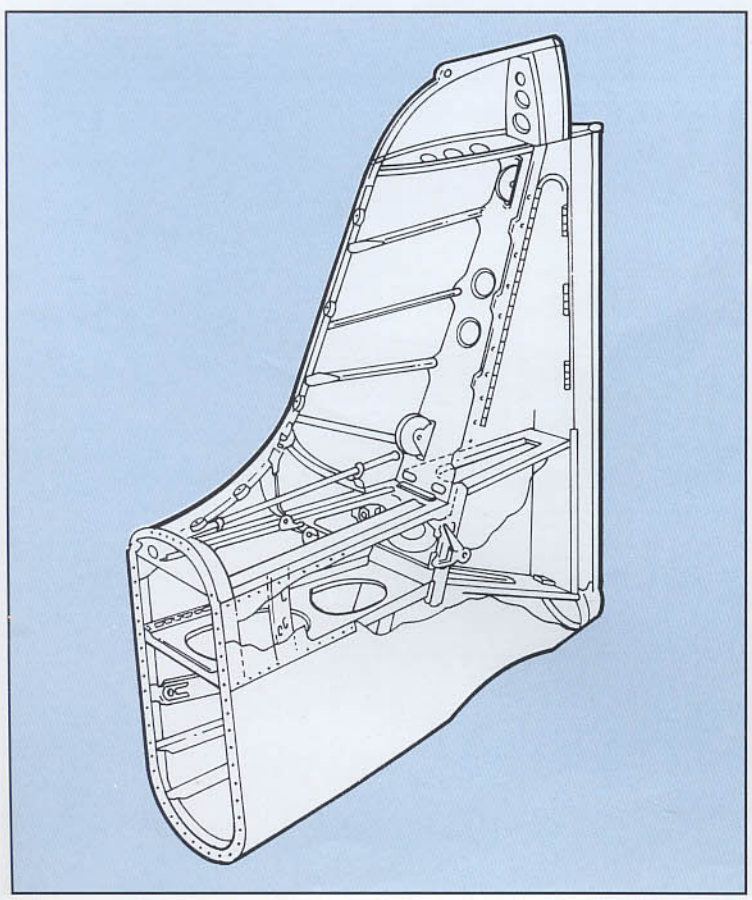
Above: A view of the remains of Ta 152 H-1, W.Nr. 150167, at Straubling, Germany, soon after the war's end. In view of the good condition of the other aircraft within this collecting point, it seems clear that this aircraft was not selected for shipment to the States, and was probably consigned to the scrap yard. Although the vertical tailplane for the Ta 152 H was generally similar to the older Fw 190 A-8 (see p. 153), there were a number of differences.

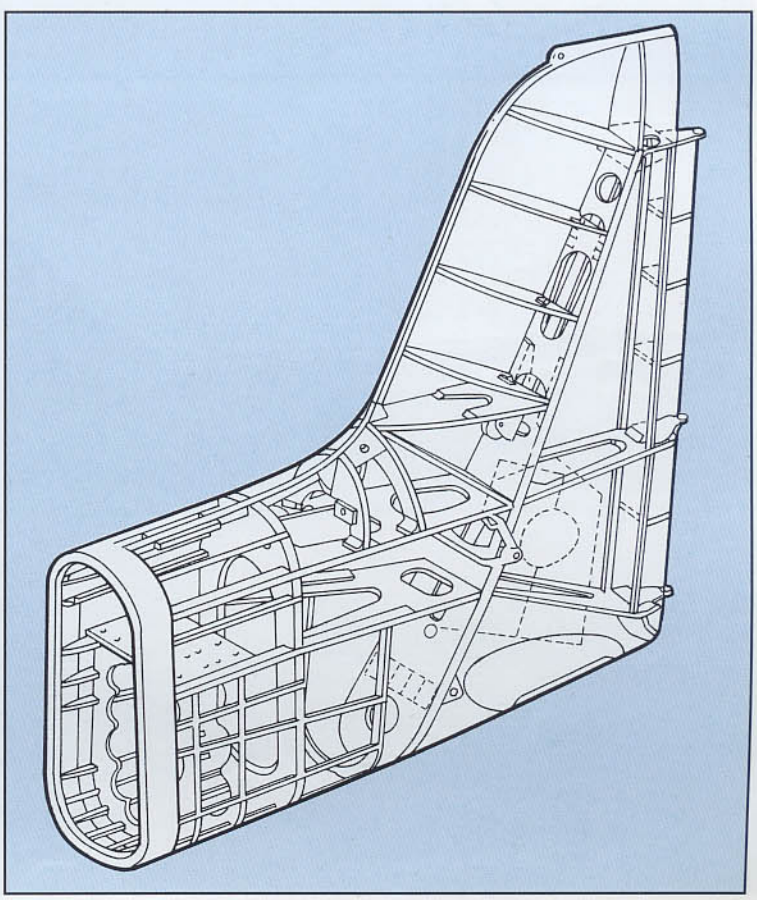
Below: A sketch of the all metal tail section common to many examples of the Ta 152 H. Partly due to Ta 152 directional problems, the Focke-Wulf engineers experimented with a number of tails, each slightly larger in area than the previous model.

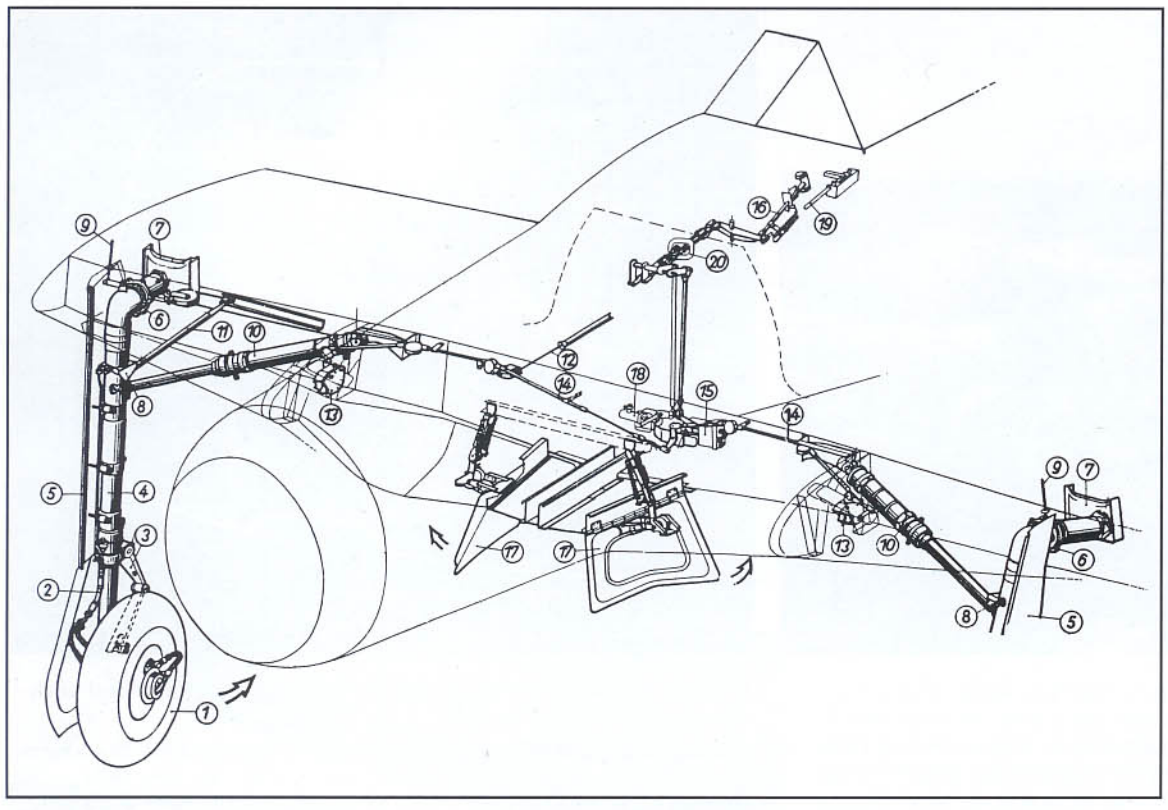


Above: A detail drawing of the standard production metal vertical tailplane for the Ta 152.

Below: This sketch shows the various components to the wooden tail design accepted for use by the Ta 152. By late 1944, numerous woodworking shops throughout Germany were fully involved in the production of various wooden components intended for aircraft. Although the idea was to conserve aluminum, and use wood instead, the end result often meant products of inferior quality which weighed more and broke more frequently due to the poor quality of special wood glues.





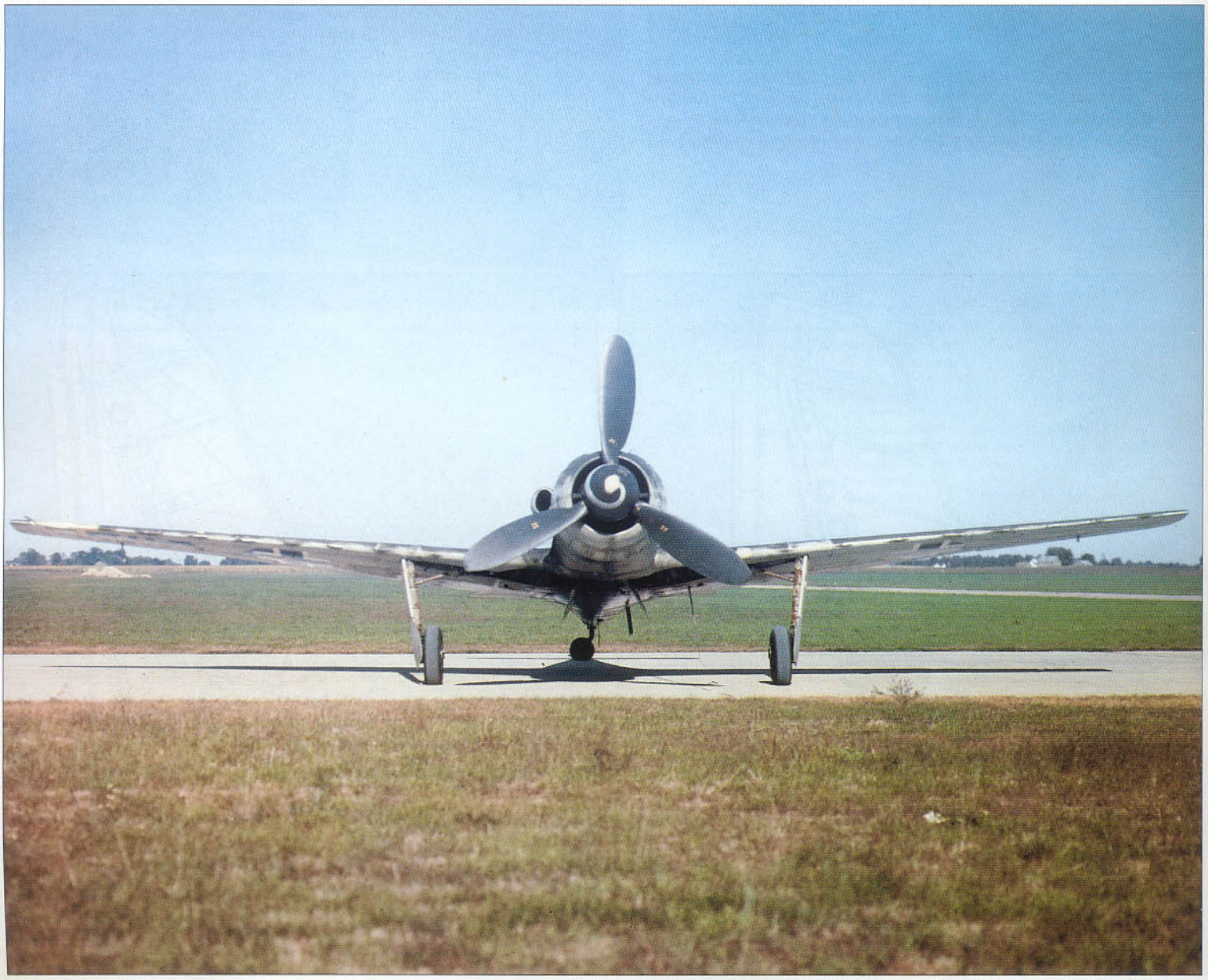


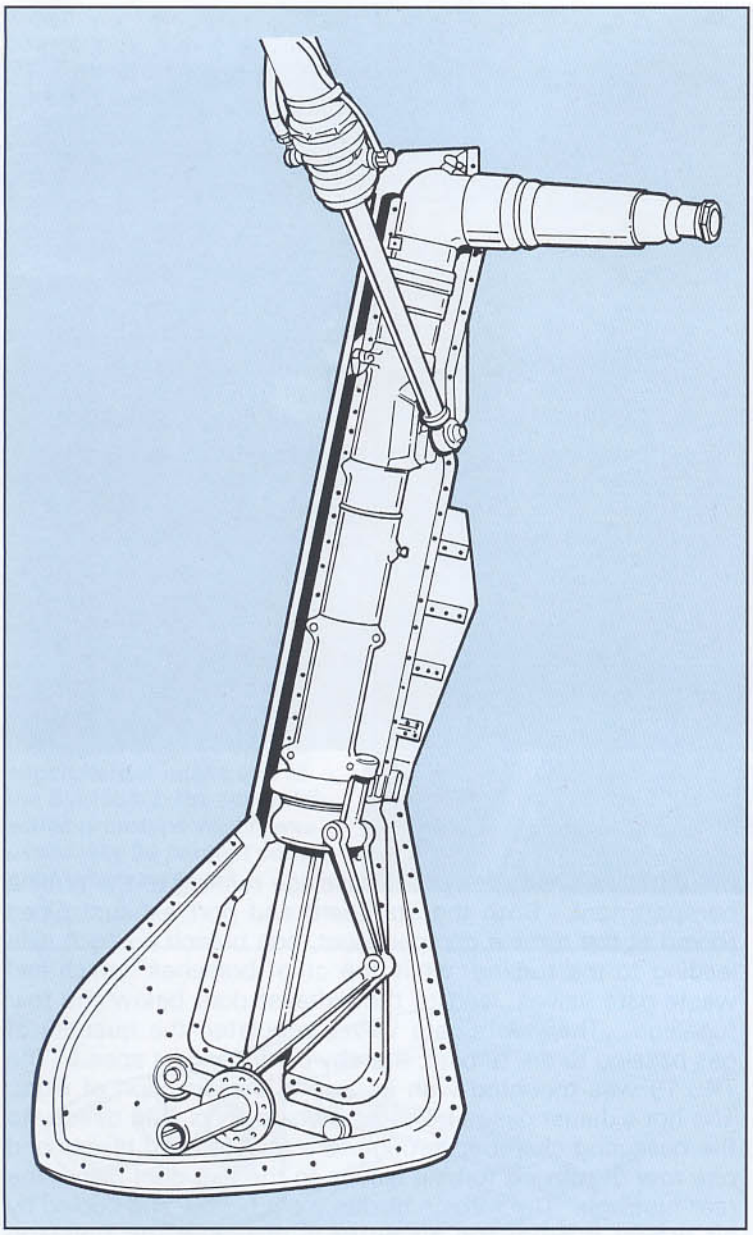
Left: A diagram of the main components to the undercarriage system for the Ta 152 H.

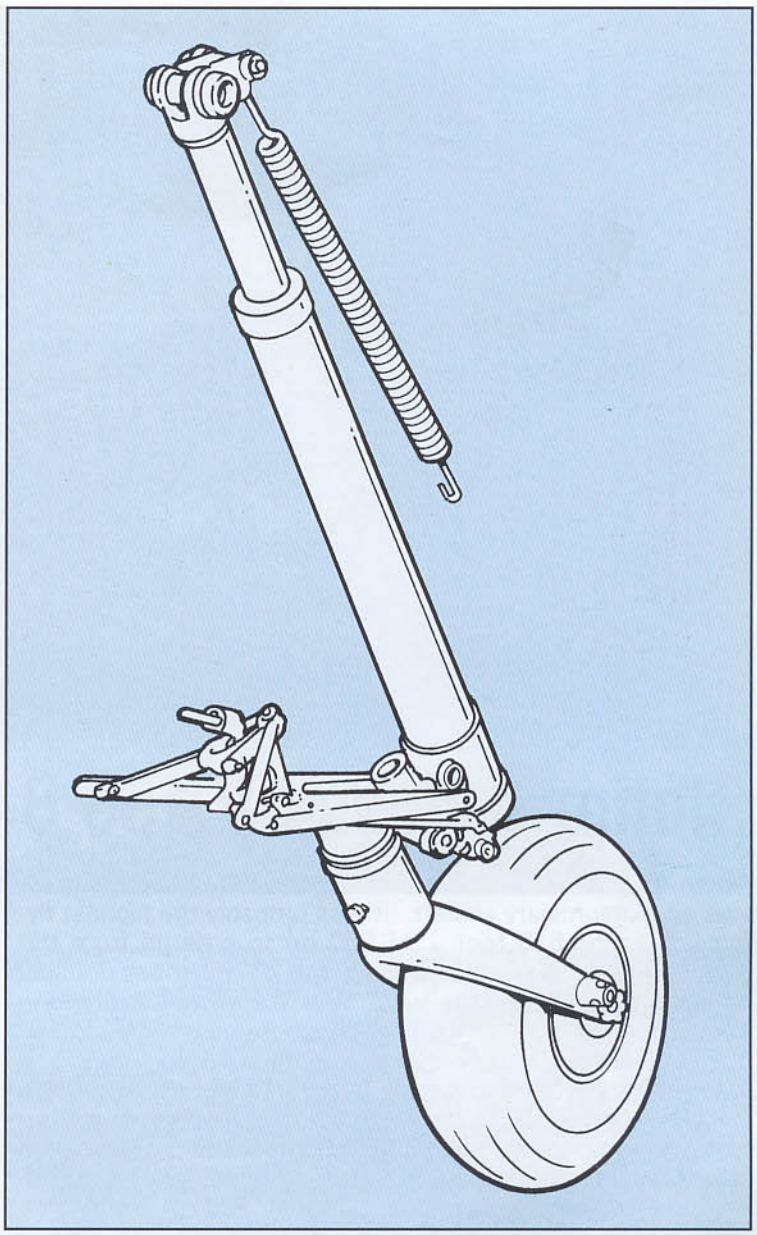
Below: A frontal view of the Ta 152 H-0 shown on page 206, FE-112, taken at Wright Field late in 1945, shows the characteristic sit of the aircraft with wheel track of 12 ft 11 in (3,954 mm).

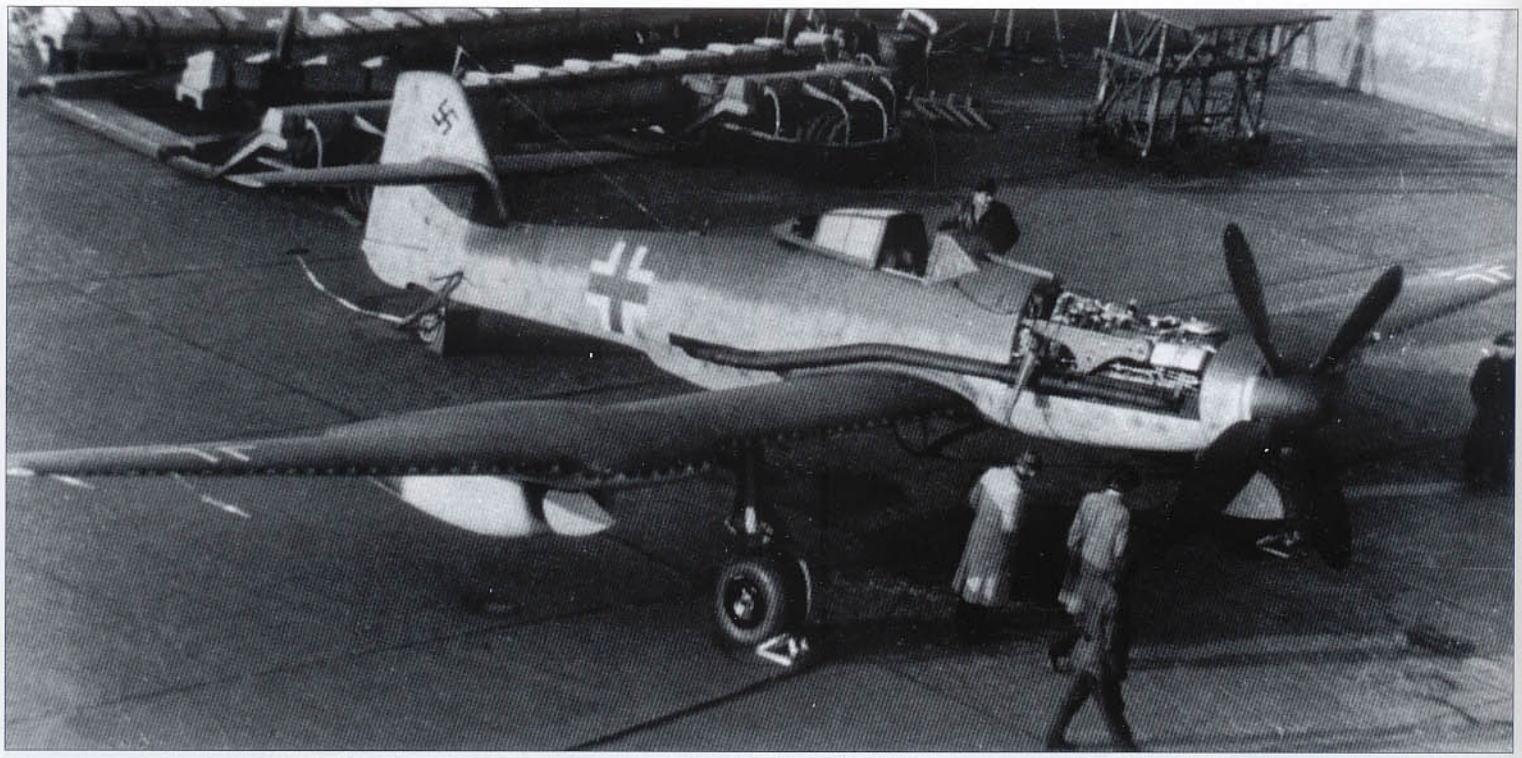
Opposite right: Two drawings of landing gear details showing the main gear strut with cover (near right) and the tailwheel assembly (far right).

Opposite bottom: A view of Ta 152 H-1/R11, W.Nr. 150168, green 9, formerly of the *Stab*/JG 301, bearing partially complete British national aircraft insignia and the air ministry number Air Min 11 along the rear fuselage.









Blohm & Voss BV 155 B-1

Flown for the first time on February 8, 1945, the BV 155 V1 was an extraordinary aircraft. It was probably the highest flying fighter (55,610 feet - 16,950 m) to emerge from the Second World War. It was also one of the most unusual appearing fighters of the war. With its exceptionally long wings spanning almost 69 feet, coupled with a fuselage length of 32 feet, plus two large underslung wing radiators, it was unlike anything currently flying. Designed to meet a special 1943 Air Ministry requirement for an *extremer Höhenjäger* (extreme high altitude fighter), the project began as a Messerschmitt creation. But, due to other commitments, *Prof.* Messerschmitt and his staff had done very little work on the project when it was transferred to the firm of Blohm & Voss, under the able leadership of *Dr.* Richard Vogt.

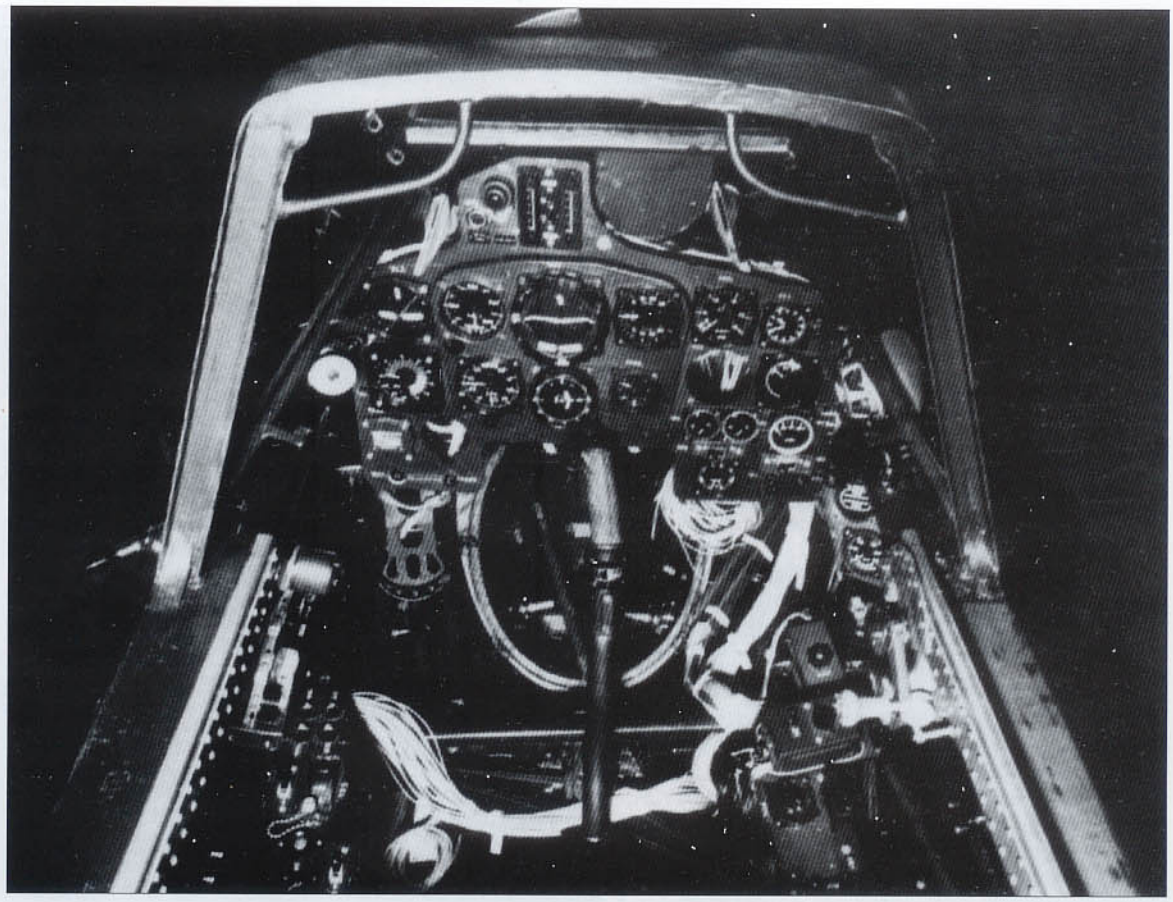
Dr. Vogt and his team quickly discovered that the original Messerschmitt design simply wouldn't work, and immediately set about to completely redesign the fighter while making an effort to retain as much of the original Messerschmitt concept as feasible. A number of powerplants were considered, but in the end, the Damiler Benz DB 603E was selected to be used in conjunction with the Heinkel-Hirth TKL 15 turbo supercharger. When used in this combination, the designation of the engine was amended to DB 603 U. The TKL 15 and DB 603 U were mutually dependent, but the latter could operate without the former engaged. When both components were functioning together, outside air was ducted through a ventrally-mounted intake, where it reached the eye of the of the TKL 15 turbo supercharger. There it was forced under pressure from the turbo's volute, to the intercooler located immediately above. From the intercooler, the compressed and cooled air was fed along a semi-enclosed duct mounted on the outside of the fuselage to the port side entry of the engine-driven, single-stage supercharger. Air from the engine-driven supercharger was first fed into the aftercooler and then into the intake manifold located between the cylinder blocks of the inverted V-type engine. Hot exhaust gasses would leave the engine via manifolds which were connected to two $5^1/_2$ inch (140 mm) exhaust pipes. The exhaust traveled to the rear via the two semi-enclosed exhaust pipes mounted on both sides of the fuselage running to the turbine compartment. Both the starboard and port exhaust pipes forked at the turbine compartment, one branch on each side leading to the turbine, while the other branches, which had waste-gate valves, lead to the exhaust duct below the rear fuselage. The waste-gate valves regulated the quantity of gas passing to the turbine, thereby controlling its speed. The TKL 15 was mounted with its axis in the direction of flight. The hot exhaust gases from the inboard forks lead directly to the collecting chamber through to a row of fixed blades and one row of moving turbine blades to the exit duct below the rear fuselage. The turbine blades were hollow and cooled by air drawn in from the air entry duct below the fuselage through a separate pipe to the center of the turbine rotor, passing outward through the blades to escape from their tips into the exhaust exit duct.

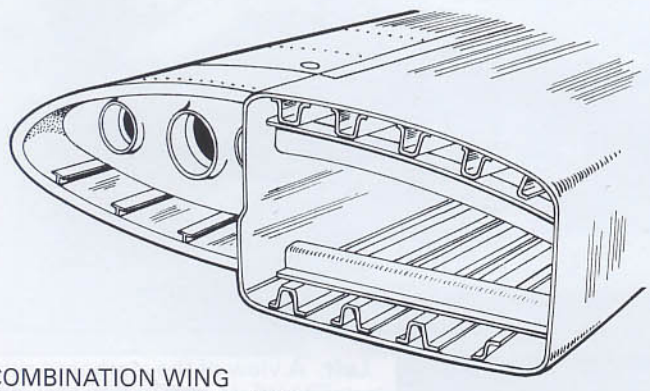
The BV 155 A featured wing radiators mounted above the wings and was not built. The first three prototypes, the BV 155 V1 through V3, were allocated to the B-1 series, but only the first prototype was actually flown. The second prototype, the BV 155 V2, was essentially 90 percent complete when captured by British forces, while the V3 was only 75 percent complete when the war ended. Armament consisted of a 30 mm MK 108 engine-mounted cannon with 75 rounds, plus two 20 mm MG 151/20 C+D cannons with 200 rpg within the wings.

Above: The BV 155 V1, W.Nr. 360051, outside Hangar 2 at the main Blohm & Voss aircraft facility at Finkenwerder, near Hamburg, Germany, late in December 1944. An extraordinary airplane, the BV 155 was probably the highest flying fighter of the Second World War with a service ceiling of 55,610 feet (16,950 m). Captured intact at the war's end, it was later destroyed when its British pilot had to make an emergency landing due to unspecified mechanical problems soon after take-off.

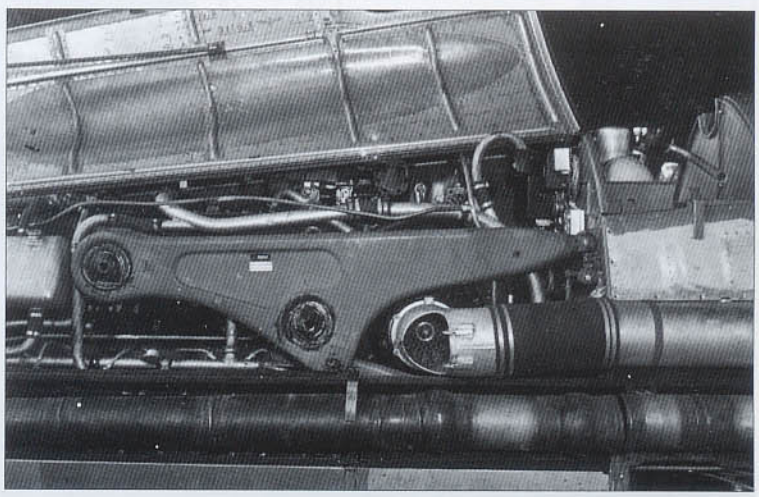
Right: A view of the incomplete cockpit of the BV 155 V1. The center panel is independently sprung and contains the blind flying instruments including (l to r top row), the airspeed indicator, turn and bank indicator, rate-of-climb/decent indicator, (l to r bottom row) altimeter, repeater compass and the AFN 2 indicator of radio navigation. Since work had not been completed when this photograph was taken, the turbine speed indicator and equivalent cockpit altitude indicator had not been installed. The ZFR-3 telescopic gun sight would have been fitted to the instrument panel if the engine cannon was to be the MK 103, and the EZ 42 Adler gun sight for the MK 108 engine cannon.

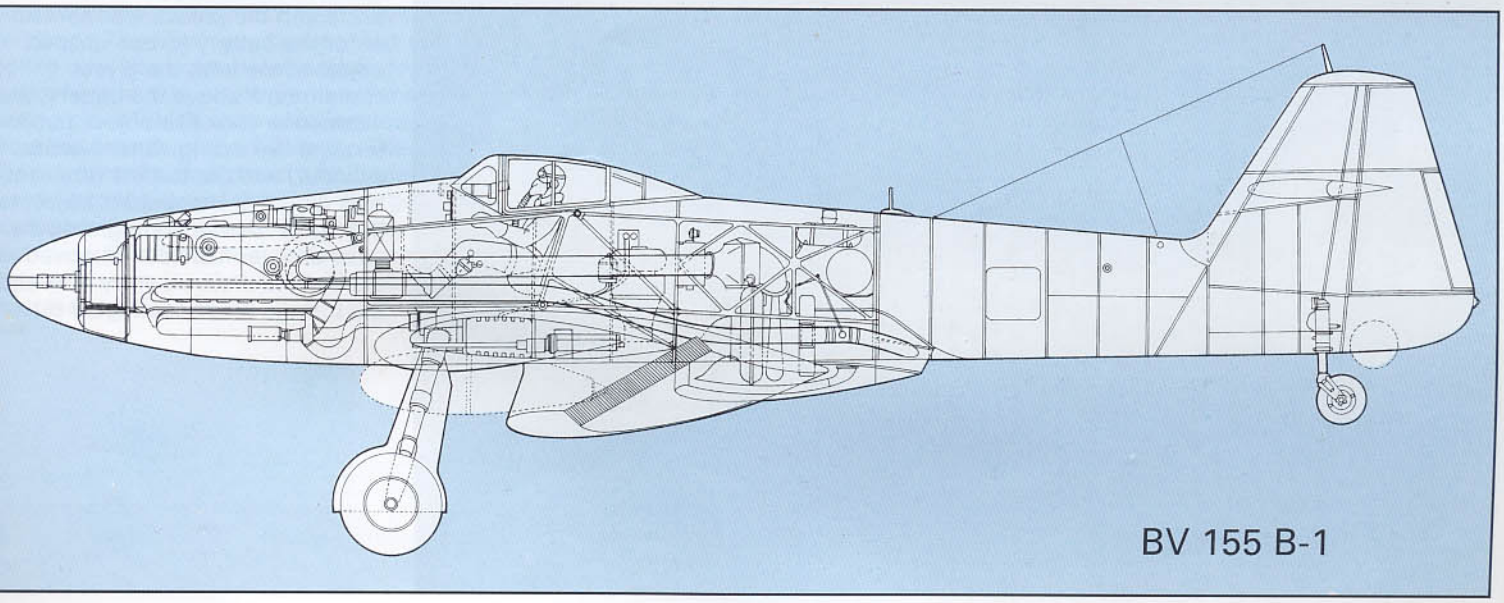
Below right: A close-up of the engine bearer arm and supercharger intake eye of the BV 155 V2, the second B-series prototype which was essentially 90 percent complete when captured.



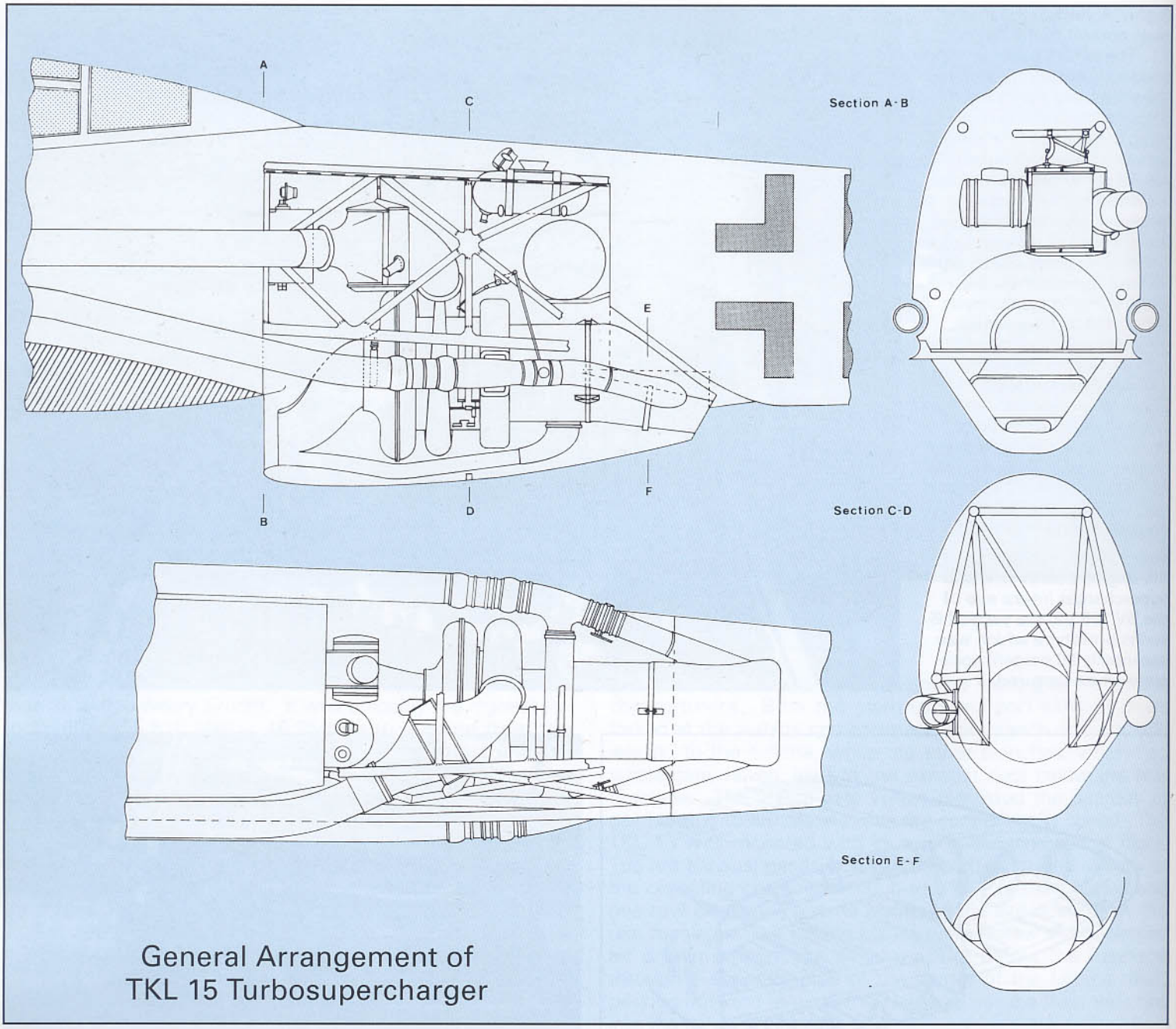


COMBINATION WING
BOX SPAR AND FUEL TANK

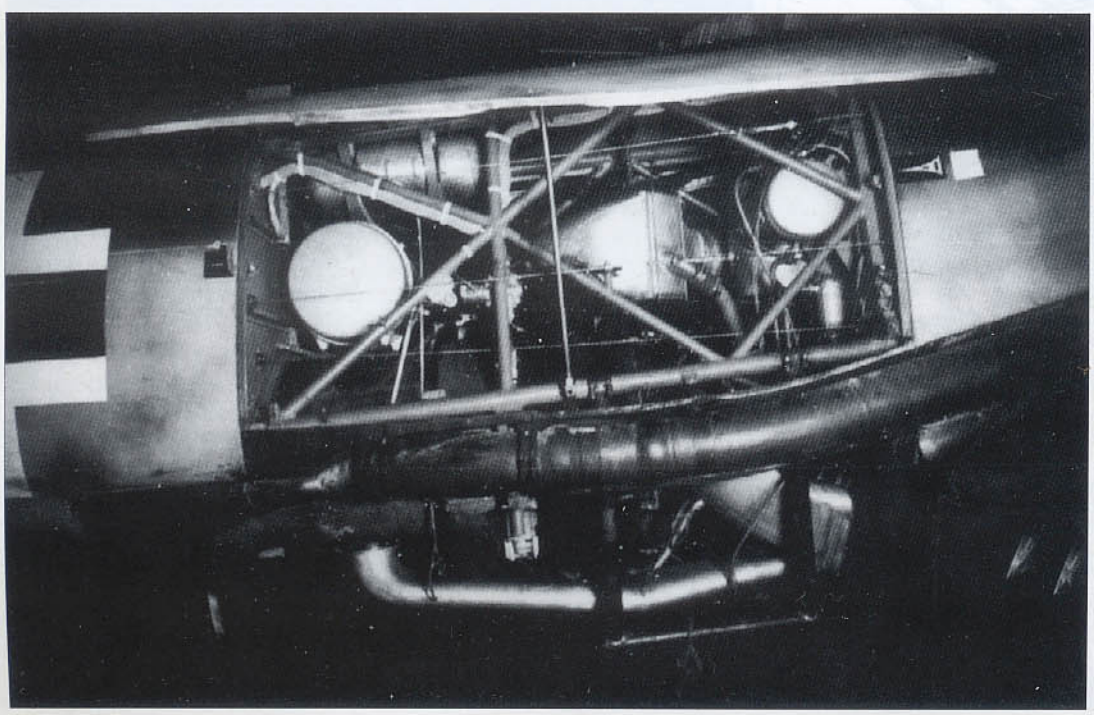




BV 155 B-1

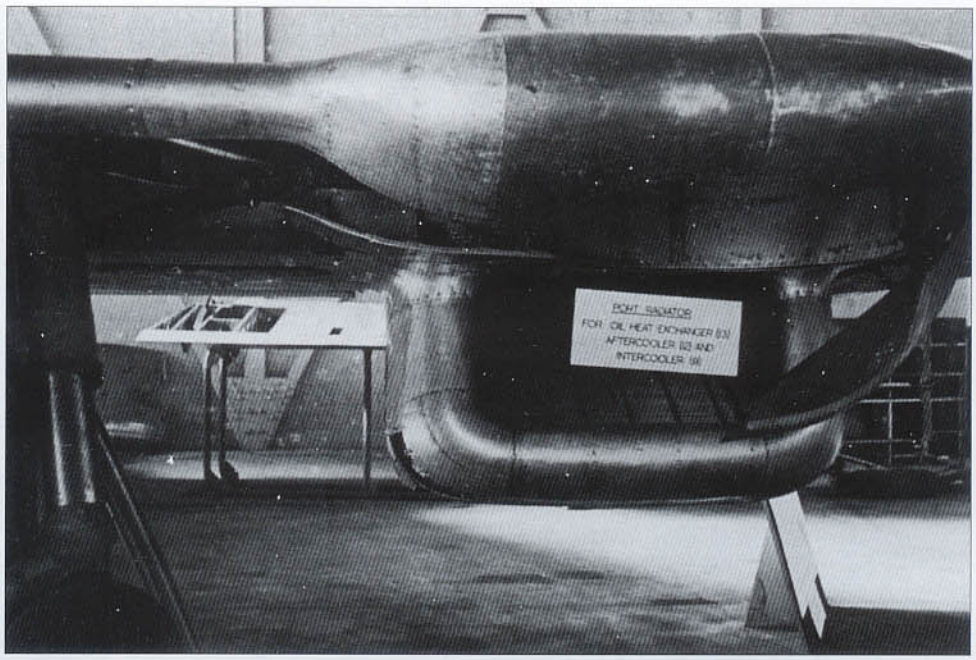


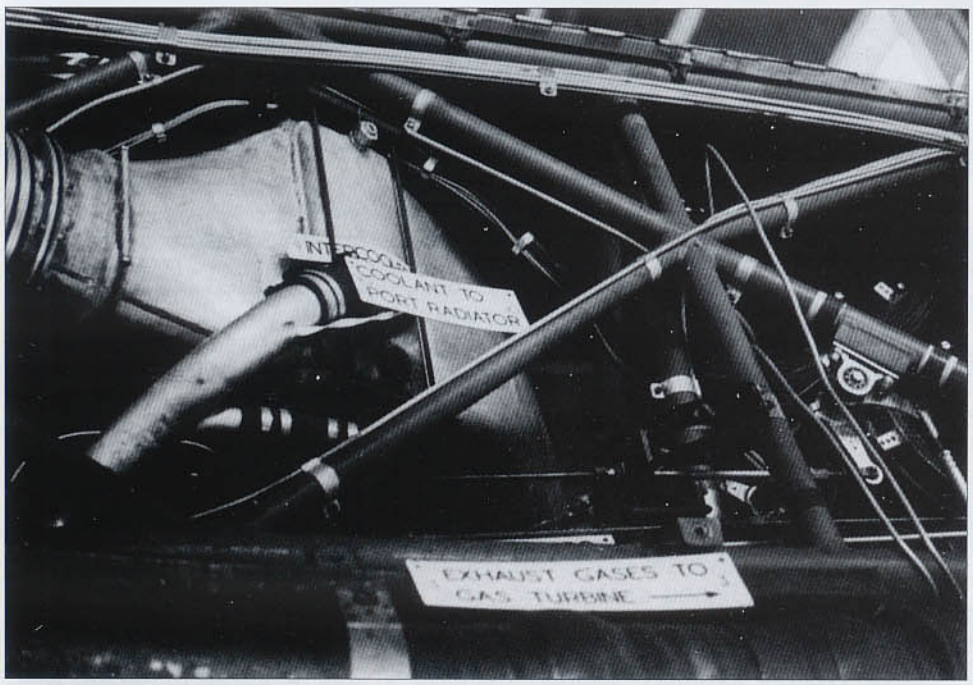
General Arrangement of
TKL 15 Turbosupercharger



Left: A view of the starboard side of the turbosupercharger compartment of the BV 155 V1 showing the welded tubular support rods enclosing the pressurized container for the battery (drum- shaped object to the left), the glycol coolant tank above the battery, the intercooler (box-like object in center), the fire extinguisher (vertical cylinder) and the turbine lubricant tank (small drum-shaped object to the right). In this photograph, the ventral cover has been removed to expose the main air entry duct and the turbine blade cooling air duct.

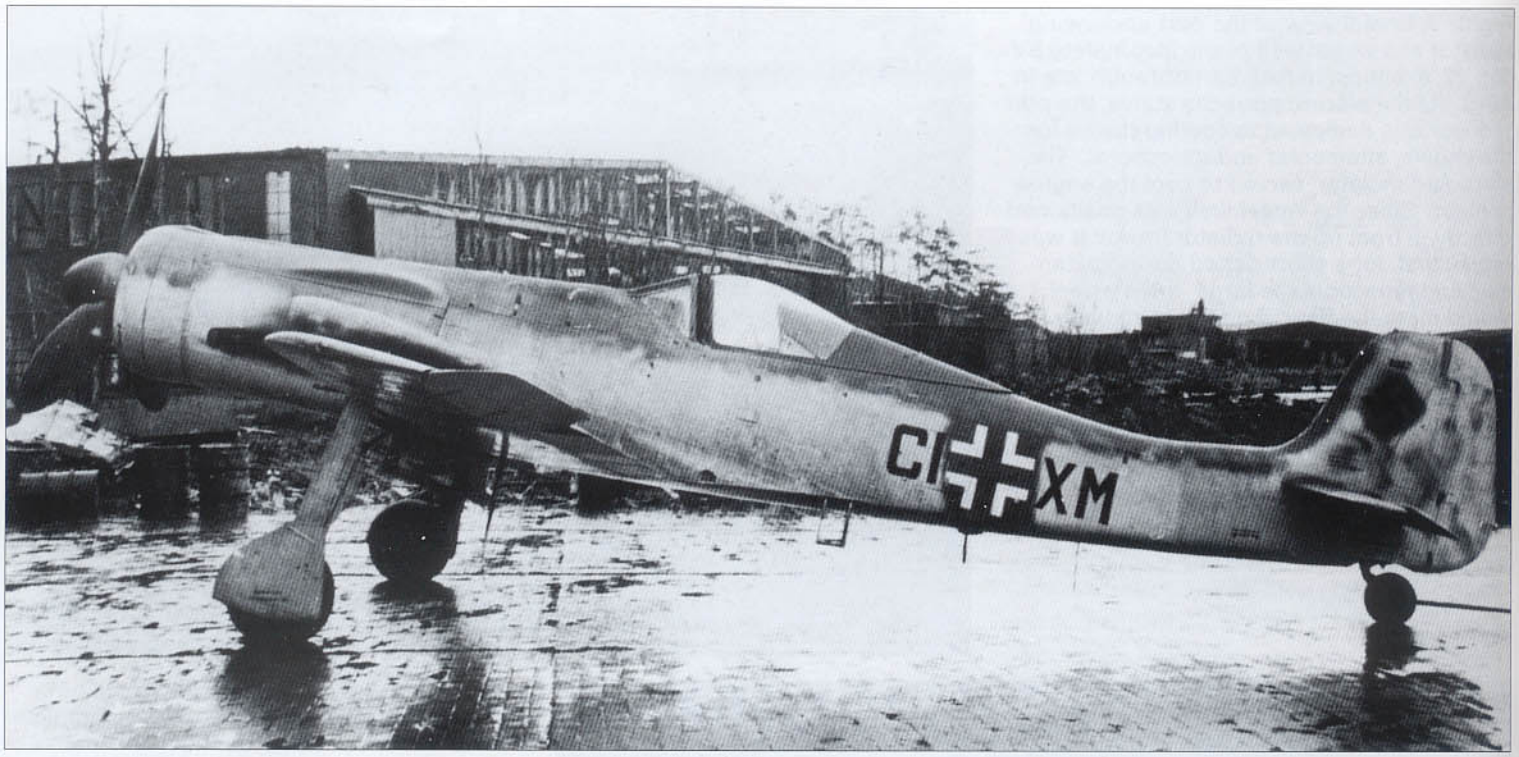
Right: A frontal view of the port underwing radiator and wheel well of the incomplete BV 155 V2 exhibited at RAE Farnborough late in 1945. As the placard correctly states, the port radiator was dedicated to cooling the oil for the engine, aftercooler and intercooler. The starboard radiator served to cool the engine coolant. Since the wheel well was positioned directly in front of the radiator intake, it was feared that, for a short period during extension and retraction, the large main wheel would mask the flow of air to the radiator. However, after careful study, it was decided that the interval when this condition would exist, was too slight to have any negative effect upon the performance of the radiators.





Left: A close-up of the port side to the turbo-supercharger compartment of the incomplete BV 155 V2. The placard identifies the intercooler (left center) and the coolant line which ran to the port radiator (shown in the photograph above). At the base of the photograph may be seen the large diameter exhaust pipe which conveyed hot exhaust from the port manifold along the exterior of the fuselage to the turbine. The ultimate fate of the second prototype is unknown, but it has been suggested that the military offered the BV 155 V2 to the British aviation industry for further testing and evaluation. Whether or not this offer was actually made, or accepted, is unknown.

Right: The sole surviving BV 155 prototype, the BV 155 V3, photographed in October 1973 at the National Air and Space Museum's restoration and storage facility at Silver Hill, Maryland. The fuselage skinning was never applied over the pressurized cockpit formers. Shown here in this photograph are the two ducting pipes which were semi-enclosed about the outside of the fuselage. The top pipe conducted compressed and cooled air directly into the eye of the supercharger located on the port side of the engine. The lower pipe transferred hot exhaust gasses rearward to the Heinkel- Hirth TKL 15 turbo-supercharger.



Focke-Wulf Ta 152 C-0 / C-1

The development of the Ta 152 C followed that of the H-series (discussed on p. 206) and differed in several respects. Unlike the Ta 152 H, the C-series was intended as a normal medium altitude fighter. Concurrent with development of the Ta 152 H, the Air Ministry gave Focke-Wulf assurance that the Ta 152 C would be a strong contender for the *Begleitjäger* (Escort fighter) requirement which was still unfilled, due to the cancellation of the Me 209/Ta 153 programs.

Initially, the Fw 190 V20 and V21 were assigned to the Ta 152 C-series development program, but it was not long before fifteen additional prototypes were assigned directly to Ta 152 C production. Of these seventeen development prototypes, only one would be entirely new. The rest would be created by modifying existing airframes. The Ta 152 V6, V7 and V8 were Ta 152 C-0 machines, but configured to C-1 standards with the DB 603L, without supercharger intercooler but with MW 50 and cowlings designed specifically for the new engine.

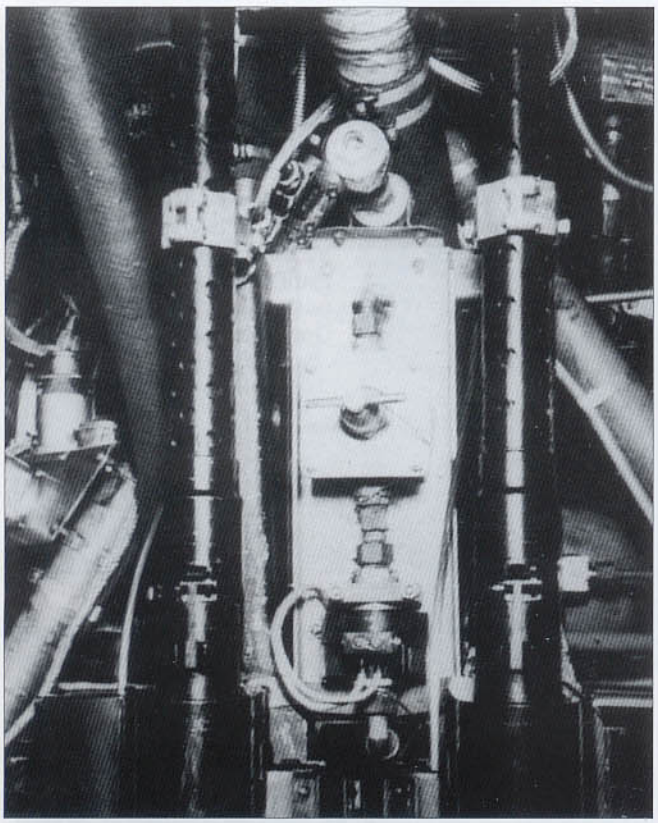
After eighteen flights with the Ta 152 V6, W.Nr. 110006, VH+EY, totaling 7 hrs. 41 min., through February 1, 1945, test pilots were generally pleased with the DB 603. After a run-in time of two hours, the DB 603 was run at emergency power (2700 rpm at 1.96 atü, boost) using MW 50 at 17,220 ft (5250 m) to attain a speed of 426.9 mph (687 km/h). The Ta 152 V7, W.Nr. 110007, CI+XM, was flown in December 1944 as the Ta 152 C-0/R11 with a DB 603 EM engine and R11 bad weather *Rüstsatz.* The Ta 152 V8, W.Nr. 110008, GN+CA, was completed late as a Ta 152 C-0, powered by a DB 603L and fitted with an EZ 42 gunsight.

Prof. Tank and his engineers were pleased with the performance of the V7, since it had the new integrated engine fairings which resulted in higher speeds. Comparative trials were made between the DB 603 E and L engines mounted in the V6. It was concluded that the DB 603 E was better suited to low altitude, while the DB 603L was superior at higher altitudes. Inasmuch as both engines required C3 fuel of 96 octane, it was decided to standardize on the DB 603LA engine for the Ta 152 C-1 *Normaljäger,* since this engine could use the lower octane B4 fuel if C3 was not available.

Armament of the Ta 152 C-0/C-1 consisted of one 30 mm MK 108 engine-mounted cannon with 90 rounds, two 20 mm MG 151/20 cannon with 150 rpg mounted above the cowl plus two similar weapons with 175 rpg installed in the wing roots.

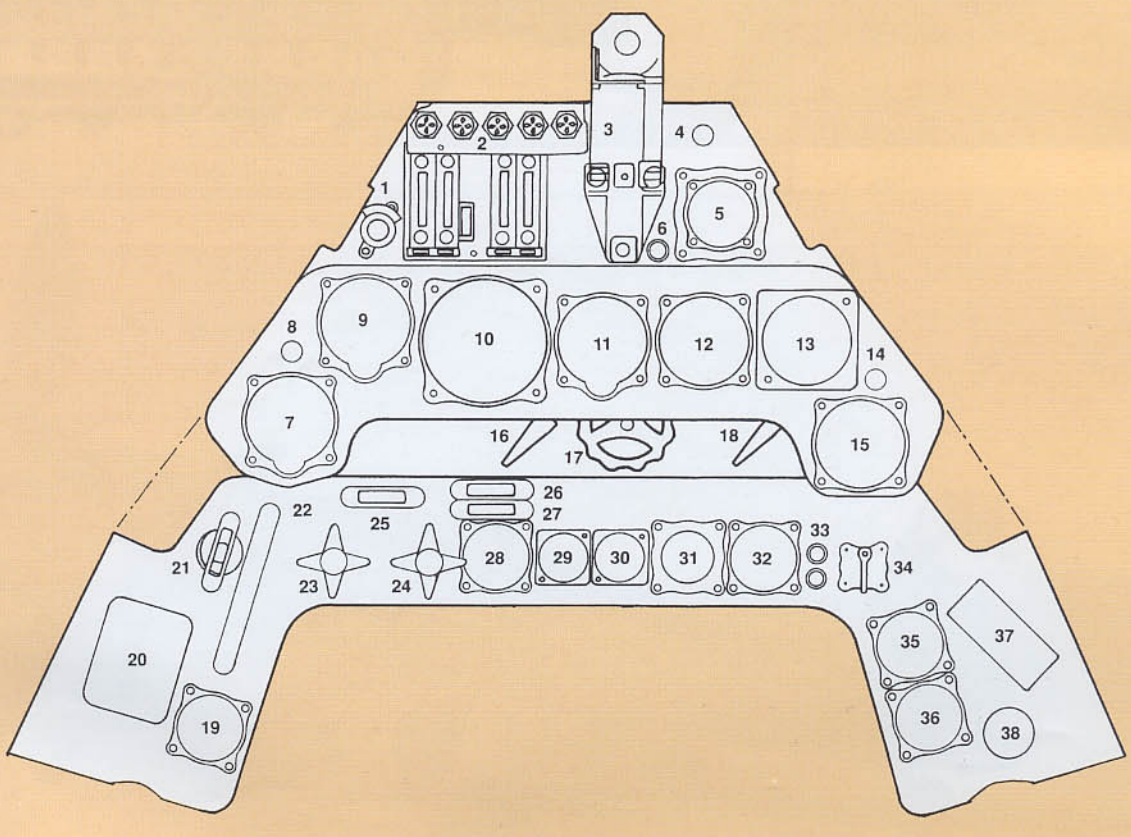
Production of the Ta 152 C-1 was to commence in March, 1945, at the ATG (Allegemein Transportanlagen GmbH) plant at Leipzig and at the Siebel works located at Halle. It is unknown how many were actually completed, but at least two Ta 152 C-1/R31s were delivered to the *Stab* JG 301 based at Welzow. The R31 auxiliary apparatus kit was a modification to address the center-of-gravity concerns. In the Ta 152 C-1/R31 the fuselage tank containing MW 50 was omitted. Instead, the MW 50 was relocated to the left wing inner and middle tanks. The remaining four wing tanks were for B4 or C3 aviation fuel.

Above: The Ta 152 V7, W.Nr.110007, CI+XM, the third prototype of the Ta 152 C-series following completion in December 1944. It was built to C-0/R11 standards and was test flown by Focke-Wulf test pilot Hans Sander on January 27, 1945.

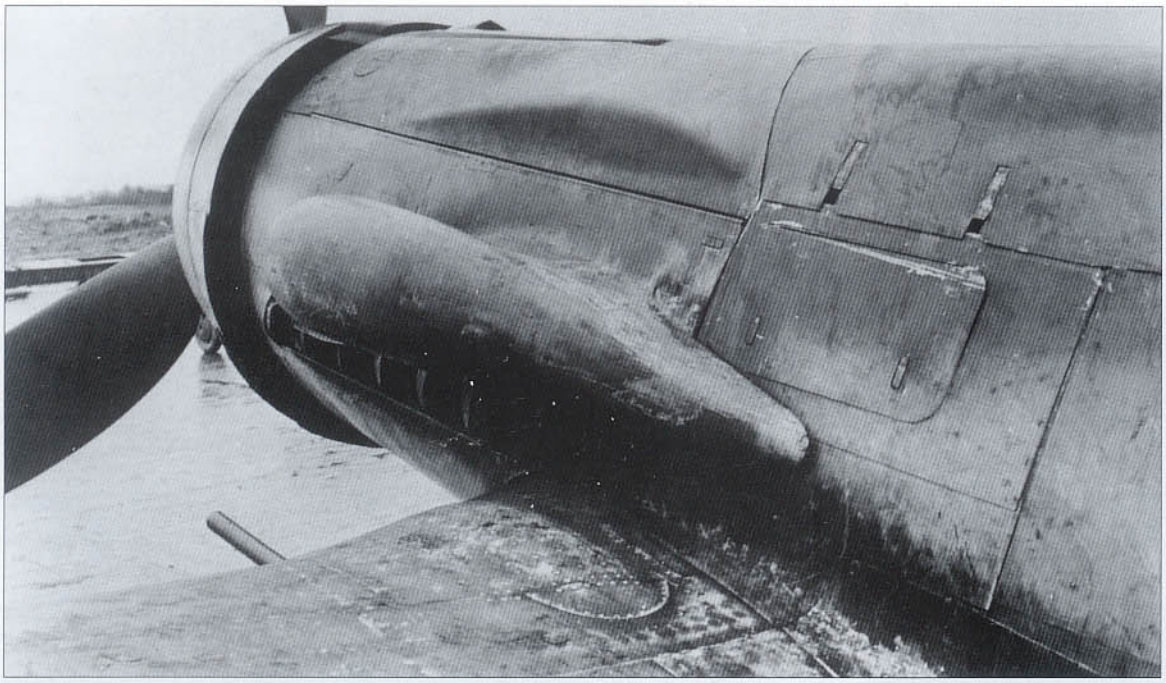


Above: A close-up of the top of the rear cowling of the Ta 152 V6 showing the installation of the twin 20 mm MG 151/20 cannons. **Right:** The 11 ft 9 inch (3,600 mm) diameter metal VDM variable pitch propeller of the Ta 152 V7 is well shown in this photograph. The spinner's opening is for the engine-mounted 30 mm MK 108 cannon. This prototype was powered by a DB 603 EM, although the DB 603 L was tested on the Ta 152 V6.

1. MK 108 cannon loading button
2. Ammunition switch and counters
3. Revi gunsight
4. Empty - not fitted
5. ANF 2 homing indicator
6. Cabin ventilation switch
7. Altimeter
8. Pitot tube heating indicator lamp
9. Airspeed indicator
10. Artificial horizon + turn and bank
11. Variometer
12. Repeater compass
13. Boost pressure gauge
14. MW 50 warning lamp
15. Fuel consumption gauge
16. Cold start switch
17. Radiator flap regulator
18. Windscreen rinsing switch
19. Hydraulic pressure gauge
20. FuG 25a radio unit
21. Undercarriage switch
22. Fire safety pet cock
23. Emergency gear lowering
24. Emergency flap lowering
25. Emergency pull for engine control
26. Wing ordnance release pull
27. Fuselage ordnance release pull
28. Fuel + oil pressure gauge
29. Coolant temperature gauge
30. Oil temperature gauge
31. Climb indicator
32. Fuel contents gauge
33. Low fuel warning lamp
34. Fuel change-over switch
35. Oxygen indicator
36. Oxygen pressure gauge
37. Signal flare pistol holder
38. Oxygen vent valve

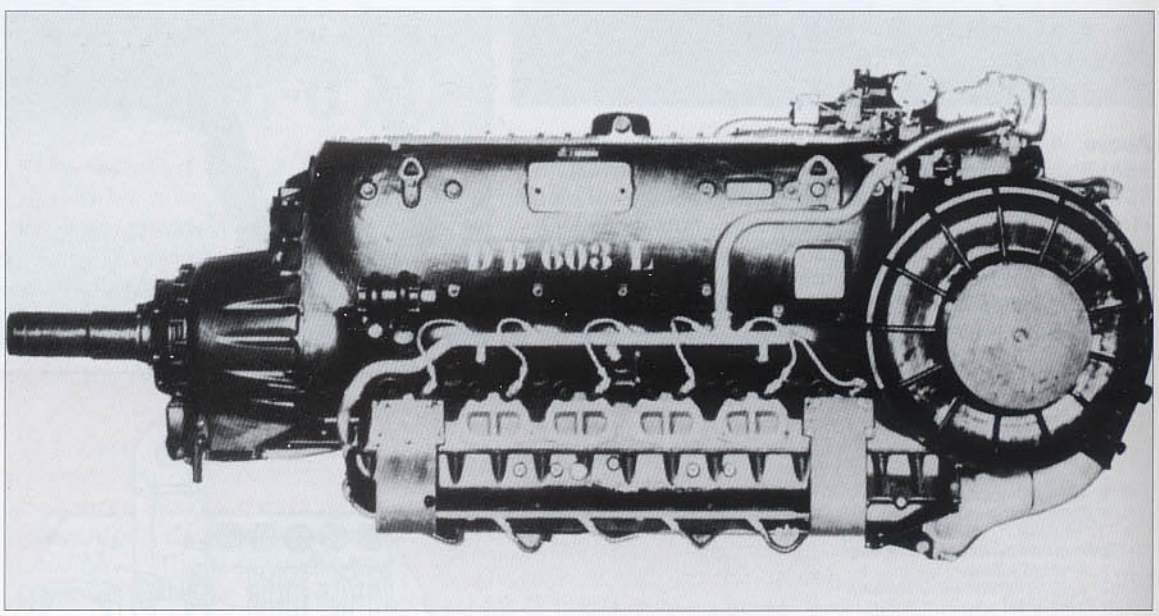


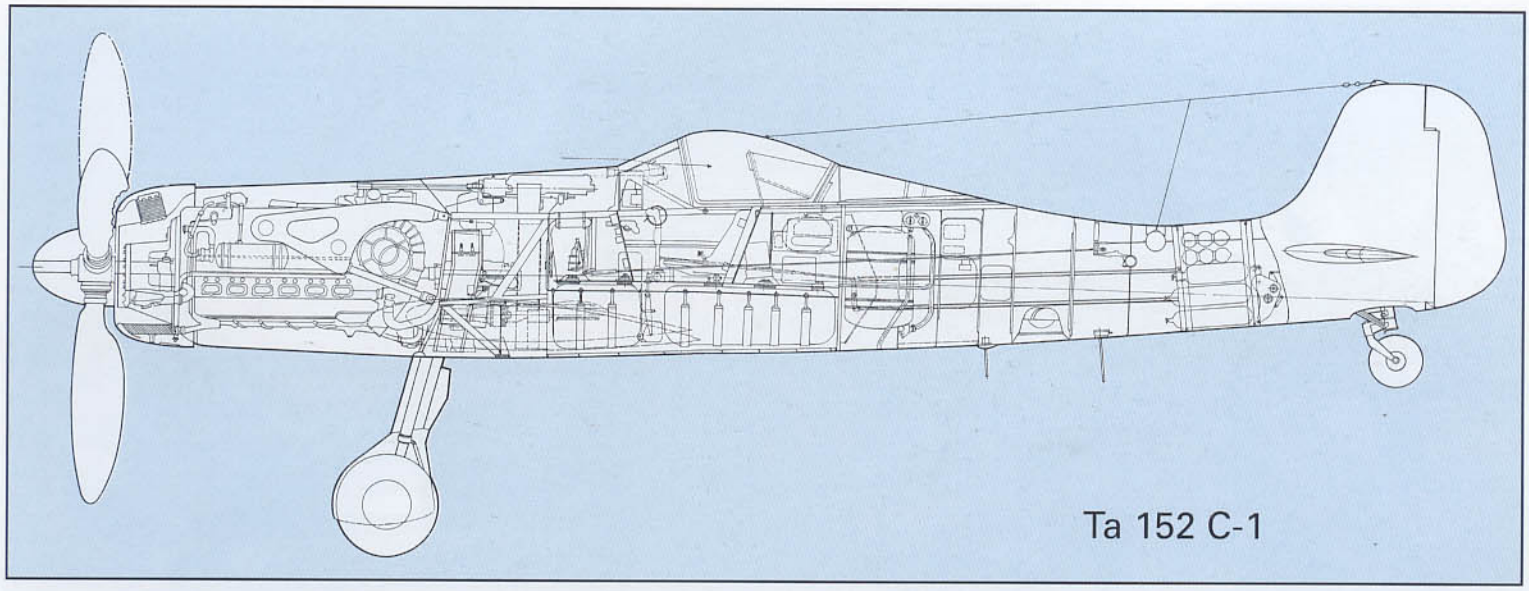
Ta 152 C-0/C-1 Instrument Panel



Left: A close-up of the port side cowling for the Ta 152 V6 showing the bulged area above the supercharger intake, made necessary by the large engine bearer arm. The Ta 152 V6, the second C-series prototype (the first being the Fw 190 V21/U1) was powered by the DB 603 L and first flown with this engine on December 17, 1944.

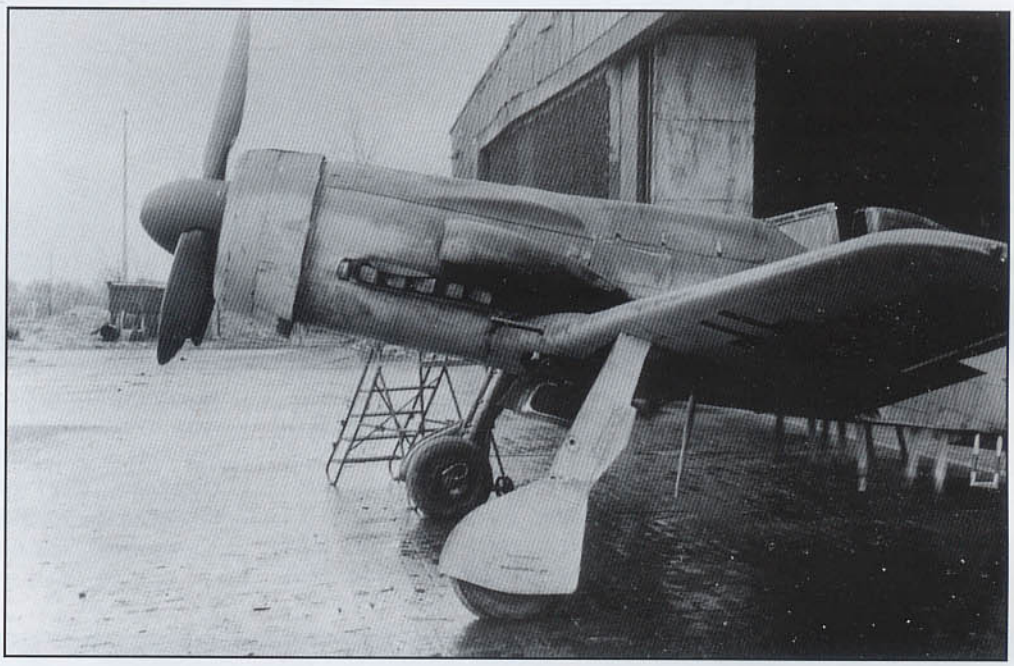
Right: The DB 603 L was the intended powerplant for the Ta 152 C-series, although this plan was amended to also include the DB 603 EM engine. The DB 603 L had a two-stage supercharger with aftercooler. When coupled with the MW 50 power-boosting system, the designation became DB 603 LA. This engine developed 2,100 hp for take-off and war emergency power at 2,700 rpm. It had an overall length of 8.9 feet (2,740 mm) and weighed 2,145 lb (975 kg).

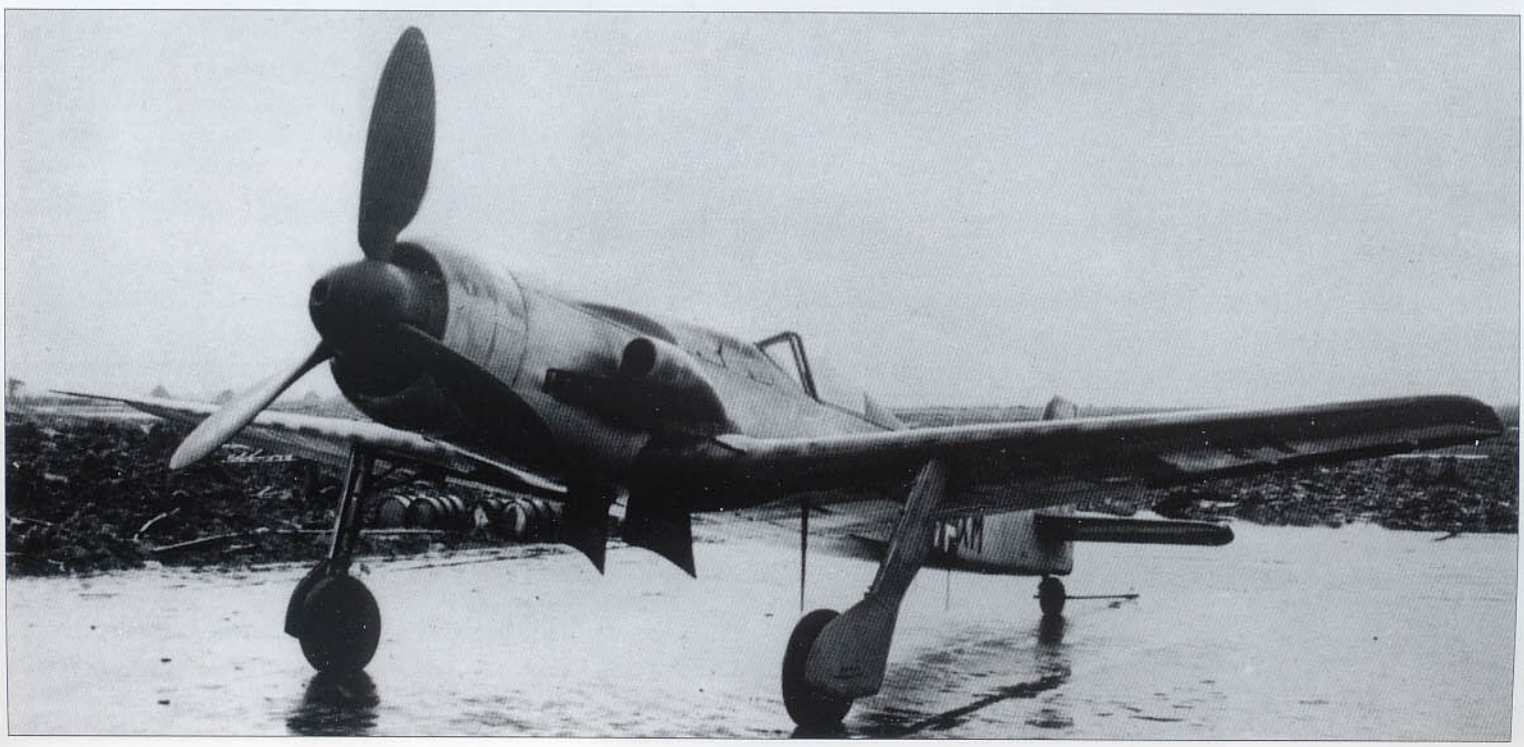




Right: The Ta 152 V6, W.Nr. 110006, VH+EY, the second C-series prototype, was flown for the first time on December 10, 1944, powered by the DB 603 E/V19,and built to Ta 152 C-1 standards. A few days later after flight tests were conducted , the V6 was re-engined with the DB 603 LA, which was the definitive powerplant for the C-1 series.

Below and opposite below: Two additional views of the Ta 152 V7, W.Nr. 110007, CI+XM, the third C-series prototype. Flight tests with the first three C-series prototypes revealed the same kind of stability problems as were being experienced with the Ta 152 H-series.





Focke-Wulf Fw 190 D-13

The final long-nose Focke-Wulf 190 variant to be powered by the Junkers Jumo 213 was the Fw 190 D-13, which like the Fw 190 D-11, was developed in parallel with the Fw 190 D-12. The Fw 190 V62 and V71 were the designated development prototypes completed in October and November, 1944, respectively. The D-13 was identical to the D-12 apart from a switch from the 30 mm MK 108 to the 20 mm MG 151/20 as the engine-mounted weapon.

The Fw 190 D-13 was to be powered by the Jumo 213 F, developing 2,050 hp for take-off and driving a Junkers VS 9 (or VS 10) propeller and was to be equipped with low pressure MW 50 injected before the third stage of the supercharger which delivered a top speed of 454 mph (730 km/h).

Originally, it had been planned to produce this series in December, 1944, but by January, 1945, it had been decided to concentrate on the Fw 190 D-13/R11. Series production was to be initiated by the Roland firm in March, 1945, using Fw 190 A-8 airframes as a basis for accelerating production. However, only two dozen of these were completed and delivered to JG 26 before the war's end.

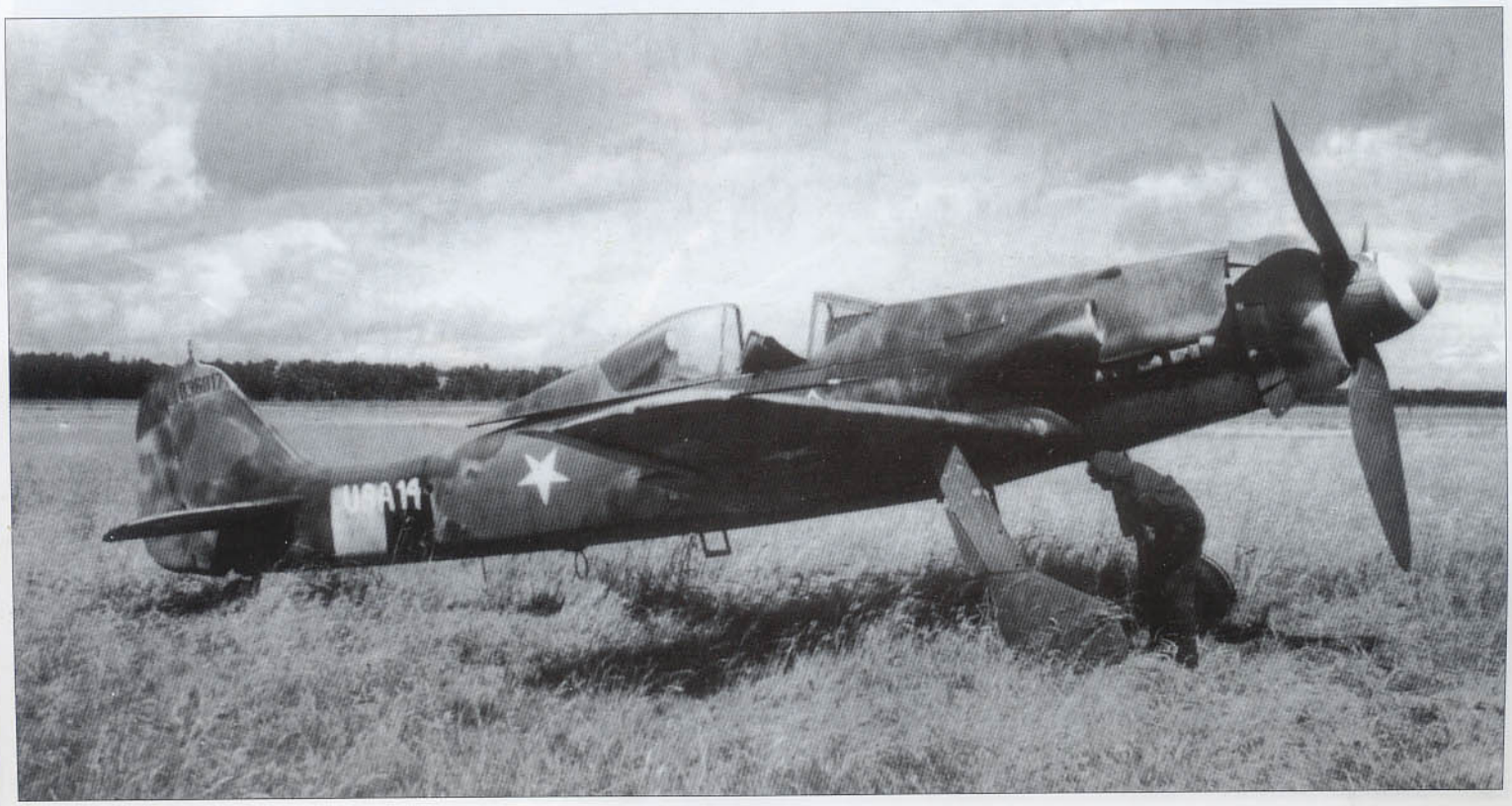
Above: Fw 190 D-13/R11, W.Nr. 836017, yellow 10, formerly of 3./JG 26, is shown here at Mesa, Arizona as part of the Champlin Fighter Museum collection. It was fitted with special bad weather equipment and powered by the Jumo 213 F.

Left: A close-up of the lower instrument panel of the fighter shows some differences from the D-9 shown on page 171

Above: An overall view of the instrument panel for the Fw 190 D-13/R11 belonging to the Champlin Fighter Museum.

Below: This photograph shows the same aircraft as shown at the top of the opposite page, as it appeared in 1945 following capture by British forces, but prior to it being shipped to the United States (note the USA 14 painted on the rear fuselage).

The aircraft arrived in the States on August 1, 1945 and was transferred to Freeman Field and received Foreign Equipment number FE-118. The D-13 series was the last Jumo-powered version of the so-called long nose Dora.



Heinkel He 162 A-1 & A-2

The He 162 has been refereed to as the "90-day wonder," since it went from an Air Ministry requirement to finished prototype in three months. This was an unparalleled feat, given the conditions and circumstances the Heinkel designers had to surmount. The RLM requirement of September 10, 1944, called for an emergency *Volksjäger* (People's fighter) to be powered by a BMW 003 turbojet. The specification called for an aircraft with a maximum speed of 457 mph (750 km/h) at sea level, a takeoff distance of under 1,604 ft (500 m) and an endurance of at least 30 minutes. Armament was to have been comprised of two 30 mm MK 108 cannons with 80 - 100 rpg, or two 20 mm MG 151/20 cannons each with 200-250 rounds. Radio equipment for bad weather operations was also to be standard. Finally, it was expected that the design should be ready for examination in three to five days.

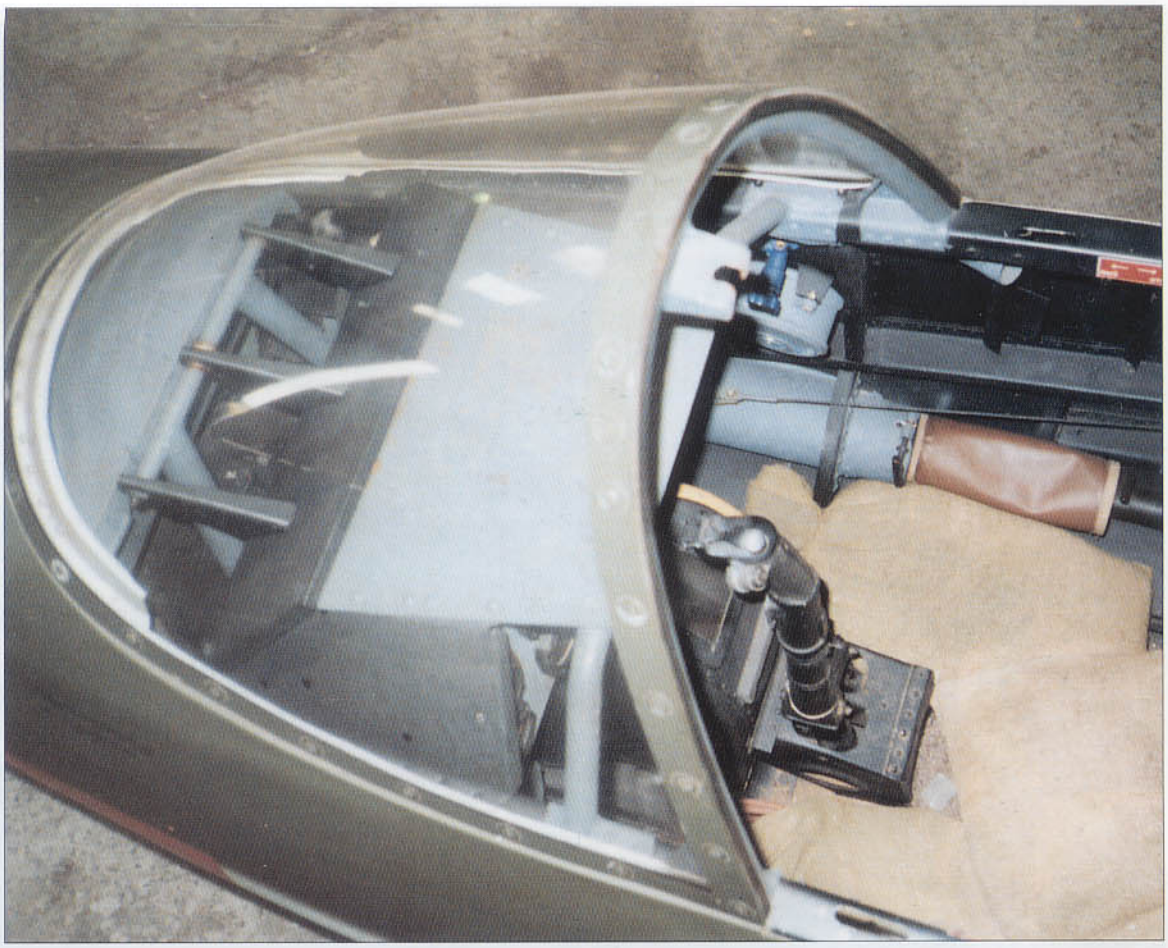
Eight companies were invited to submit proposals, and when each was examined, the field was narrowed down to the Blohm & Voss P 211 and the Heinkel P 1073, with the Air Ministry awarding the contract to Heinkel on September 23, 1944.

Although the early He 162 prototypes were to be built at Heinkel's Vienna facility, four other assembly sites were chosen for production aircraft. These included Heinkel's northern plant, located at Rostock on the Baltic; a new large underground facility established in a former chalk mine at Hinterbrühl near Vienna; the Junkers factory at Bernburg; and the huge underground Mittelwerke GmbH complex at Nordhausen.

Only two production variants of the *Volksjäger* are known, the He 162 A-1 and A-2, in spite of the fact a number of projects were planned or investigated. The He 162 A-1 was fitted with two 30 mm MK 108 cannons with 50 rpg, while the otherwise similar He 162 A-2 was armed with two 20 mm MG 151/20 cannons with 120 rpg.

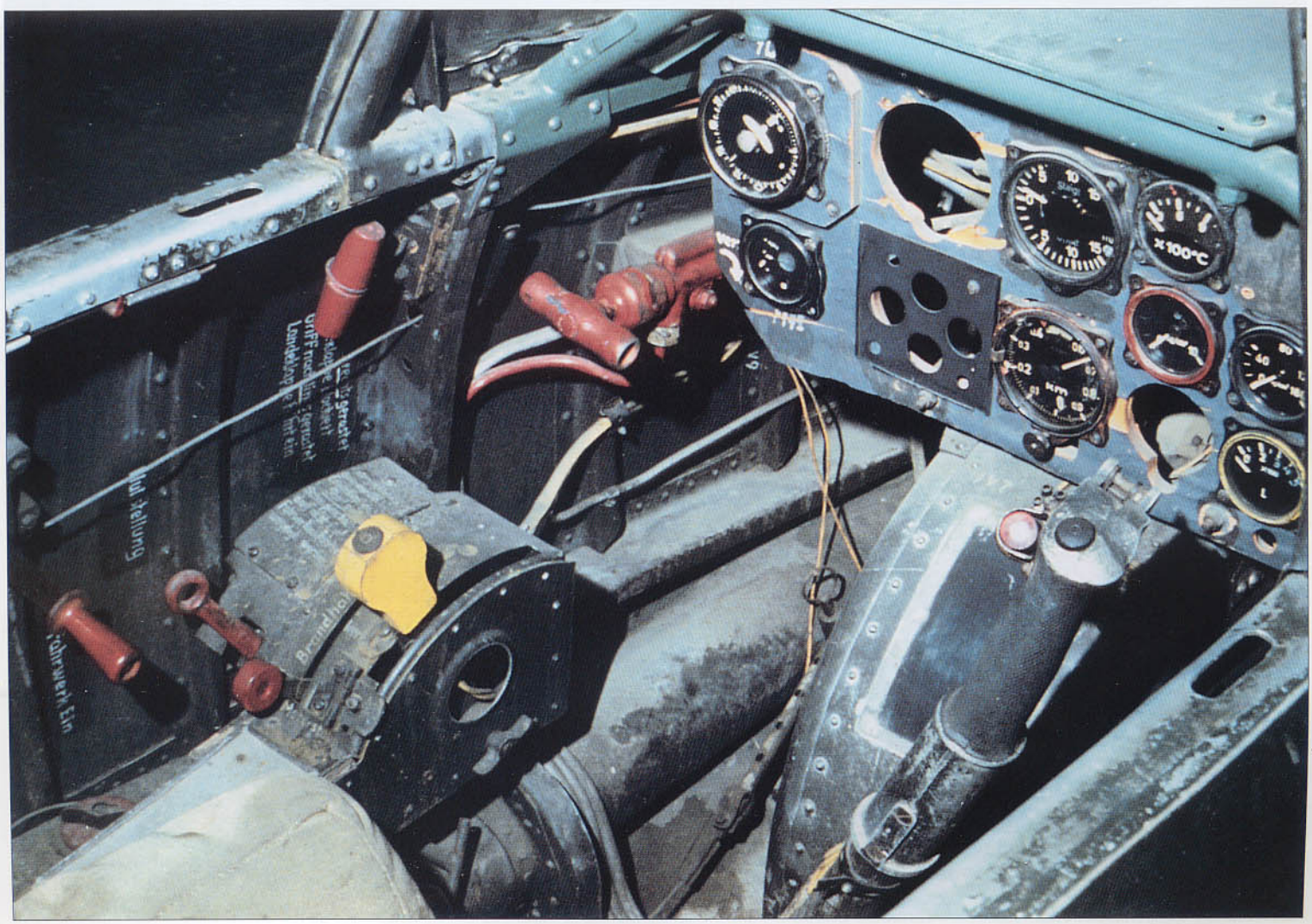
On January 14, 1945, the first Rostock-built He 162 A-2, W.Nr. 120001, was completed followed by the first Hinterbrühl aircraft, He 162 A-01, W.Nr. 220001, VI+IK, a short time later. The first Junkers-produced aircraft, He 162 A-1, W.Nr. 300001, flew for the first time on February 25, 1945, from Bernburg. At about this time, the first Mittelwerke-built He 162 A-1, W.Nr. 310001, was completed. At least 39 He 162s were completed between Junkers and Mittlewerke before the war's end. Total production for the He 162 amounted to approximately 238 completed aircraft, with another 800 under construction throughout Germany at the war's end.

Above: Heinkel He 162 A-2, W.Nr. 120227, red 2, formerly with 2./JG 1 based at Leck in Schleswig-Holstein, Germany, following restoration at RAF St. Athan, South Wales, during 1979. This example of the *Volksjäger* was one of eleven brought to Britain after the war. The jet fighter was a little tricky to fly; especially at low speeds. But, with a qualified pilot at the controls, it generally met or exceeded its design requirement. During one postwar test flight, a speed of 562 mph (904 km/h) was attained at an altitude of 41,200 feet (12,558 m).

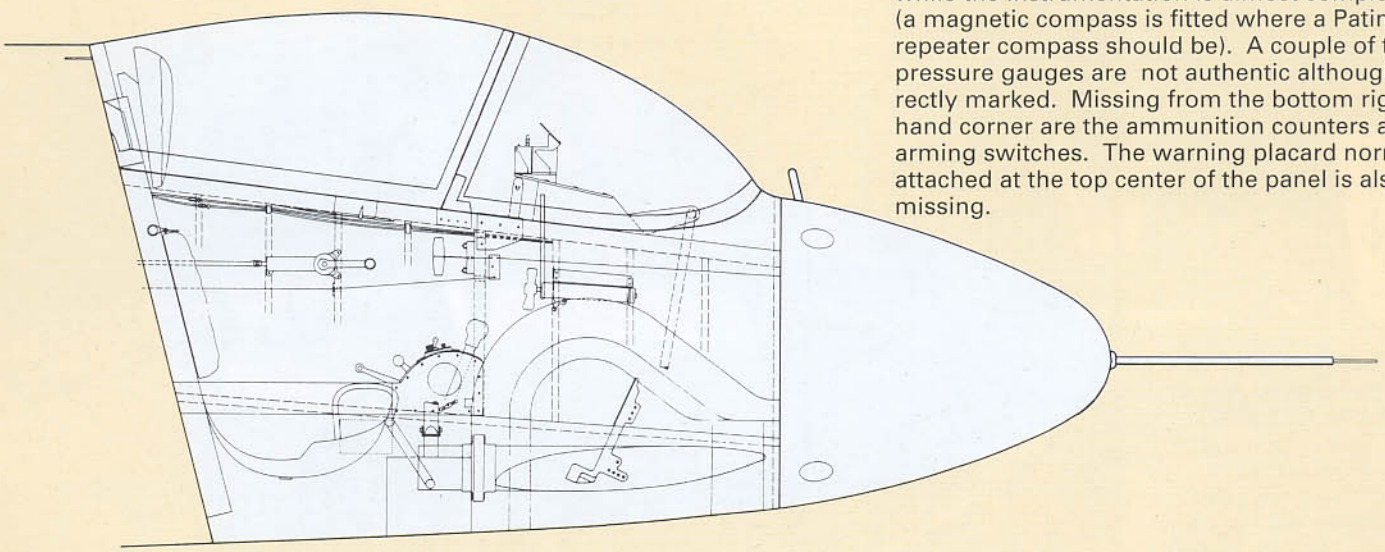


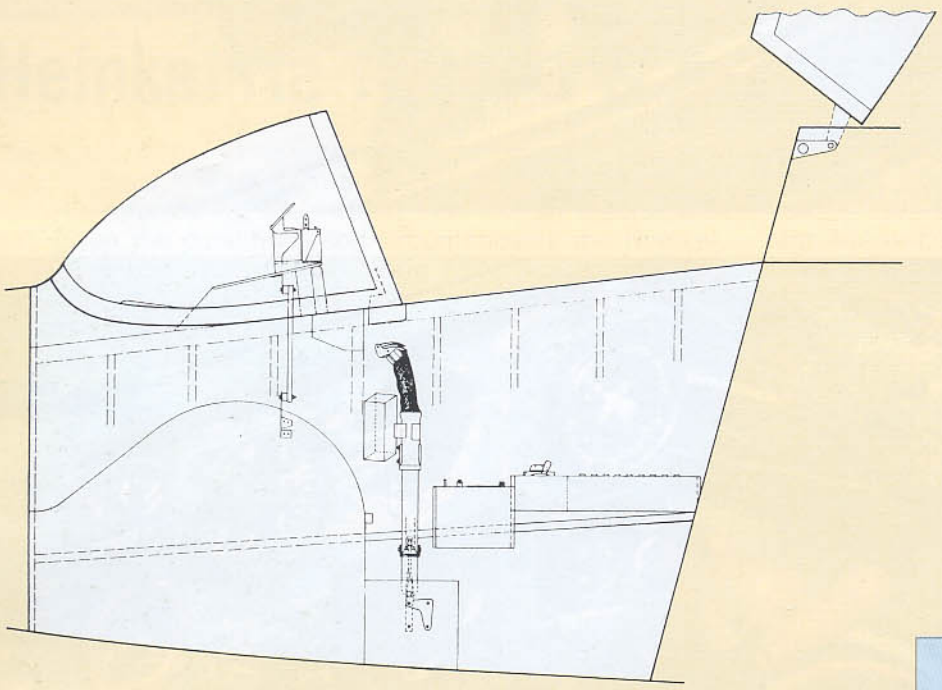
Right: Looking down into the very compact cockpit of He 162 A-2, W.Nr. 120227, note the suspension frame for the instrument panel coaming. The three sand bags shown on the flooring were placed here for ballast.

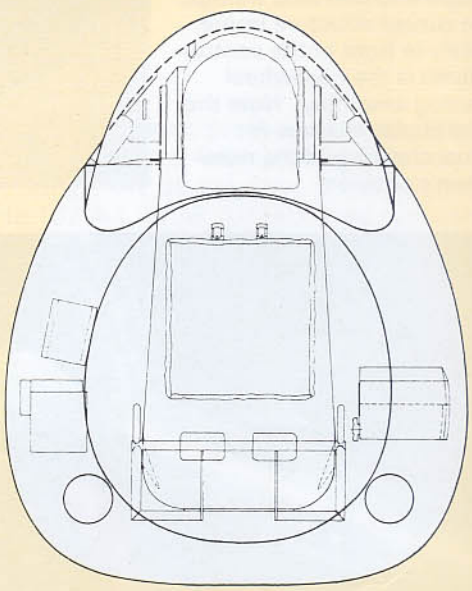
Below: General view of the cockpit and port side fittings. The curved structure immediately in front of the control column is the nosewheel housing assembly. Note the clear plastic window for visual checking of the nosewheel's position.

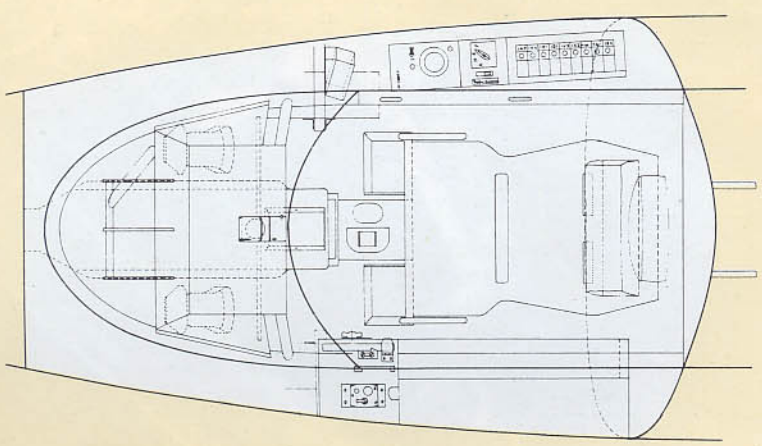


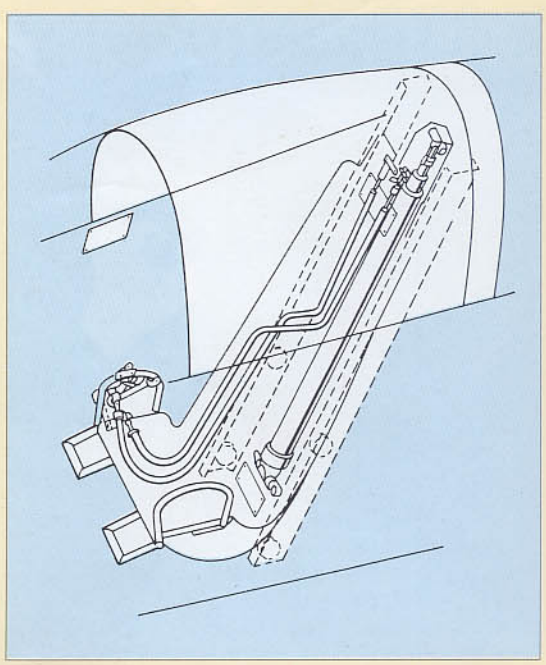
Opposite right: The instrument panel with its heavy top coaming plate which forms part of the main structure. The Revi gunsight is missing while the instrumentation is almost complete (a magnetic compass is fitted where a Patin repeater compass should be). A couple of the pressure gauges are not authentic although correctly marked. Missing from the bottom right hand corner are the ammunition counters and arming switches. The warning placard normally attached at the top center of the panel is also missing.



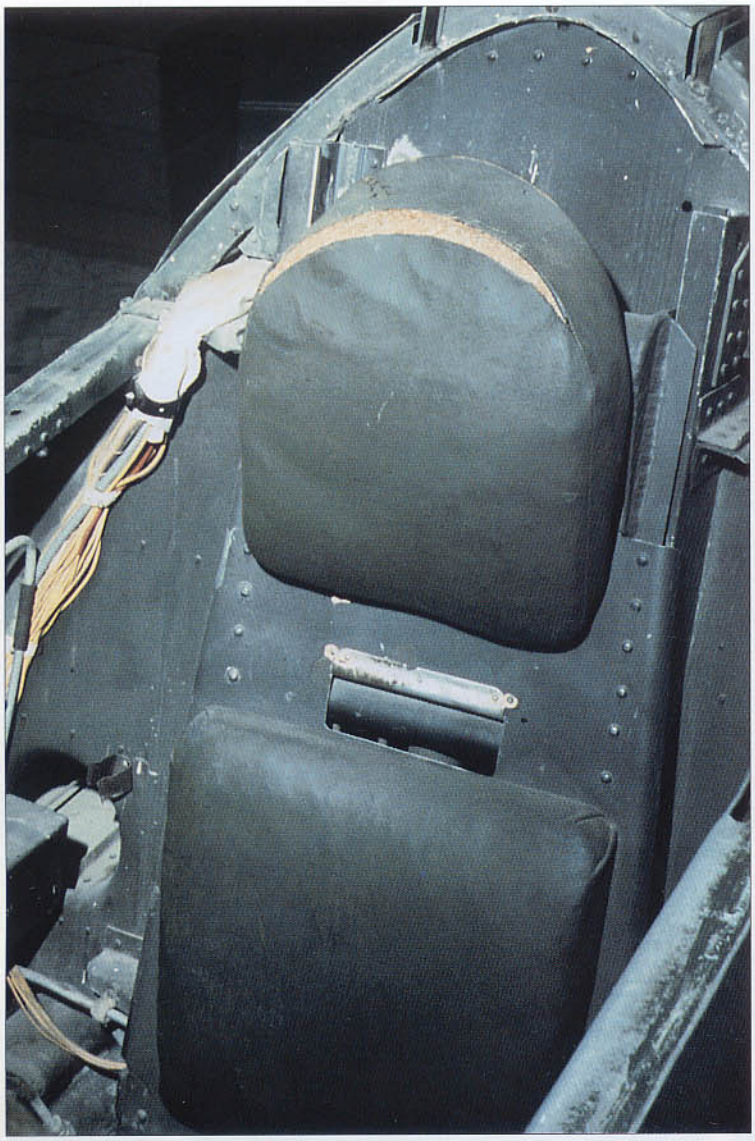


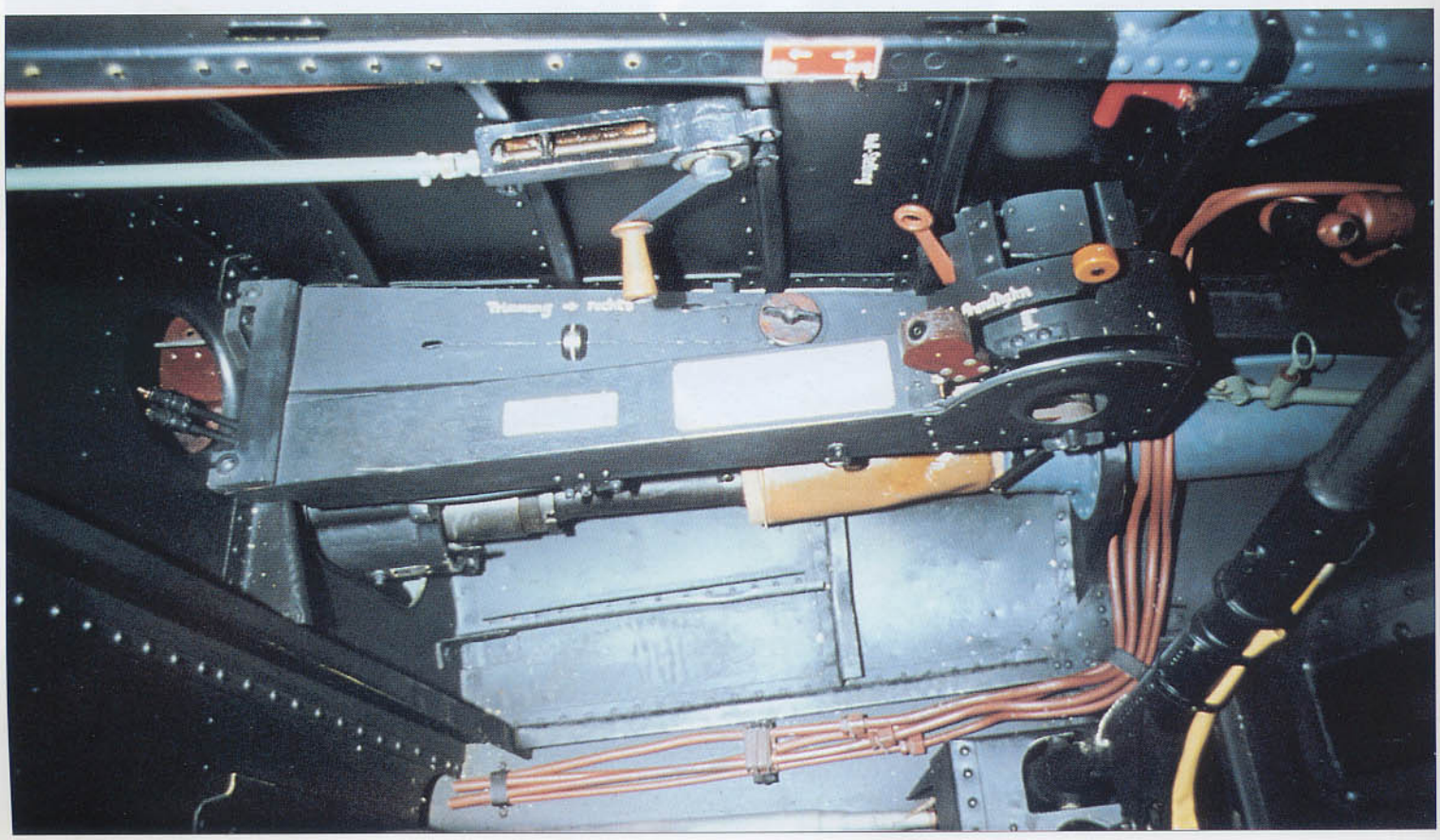






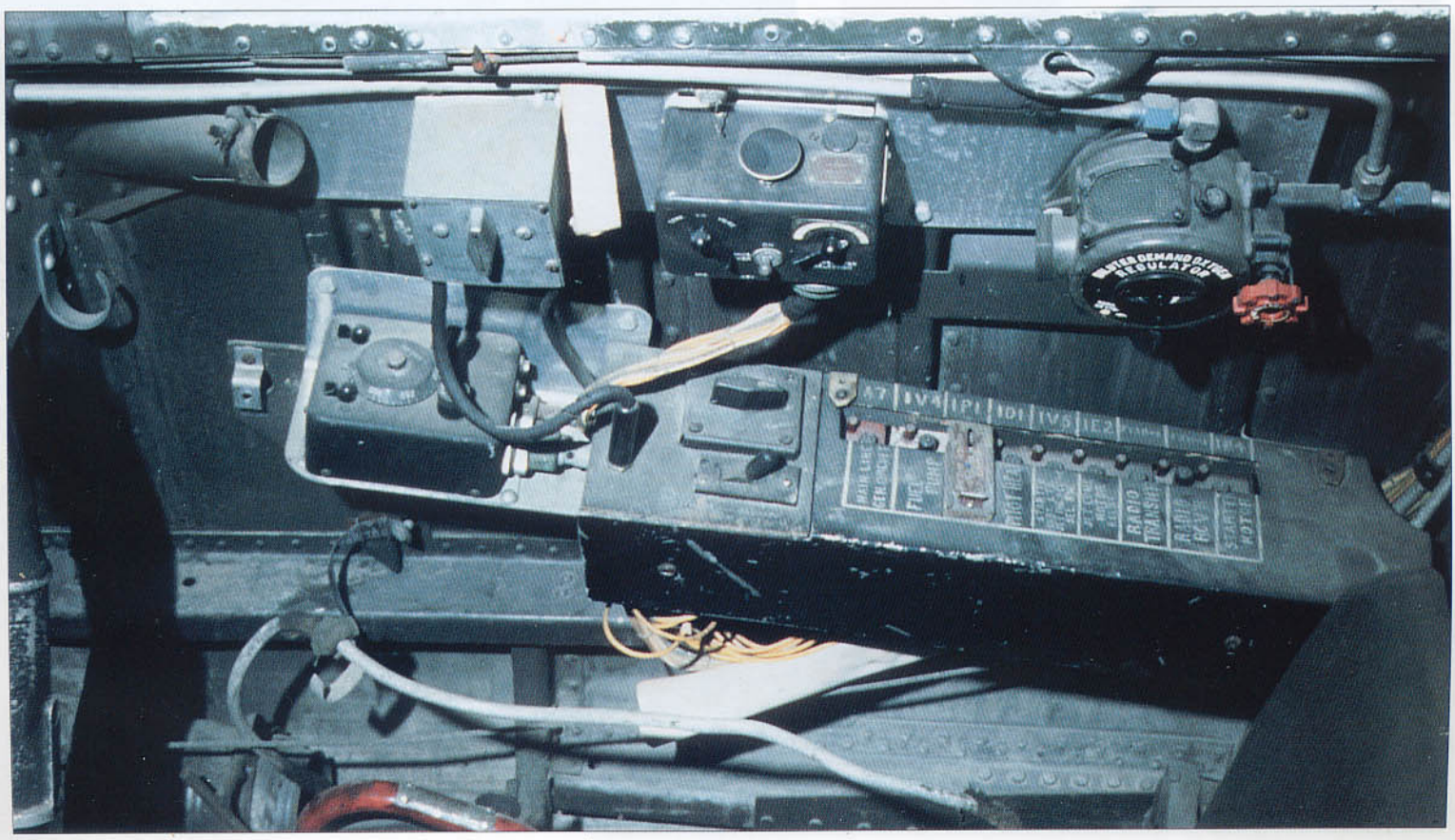

×100°C
1P5
1P4
km

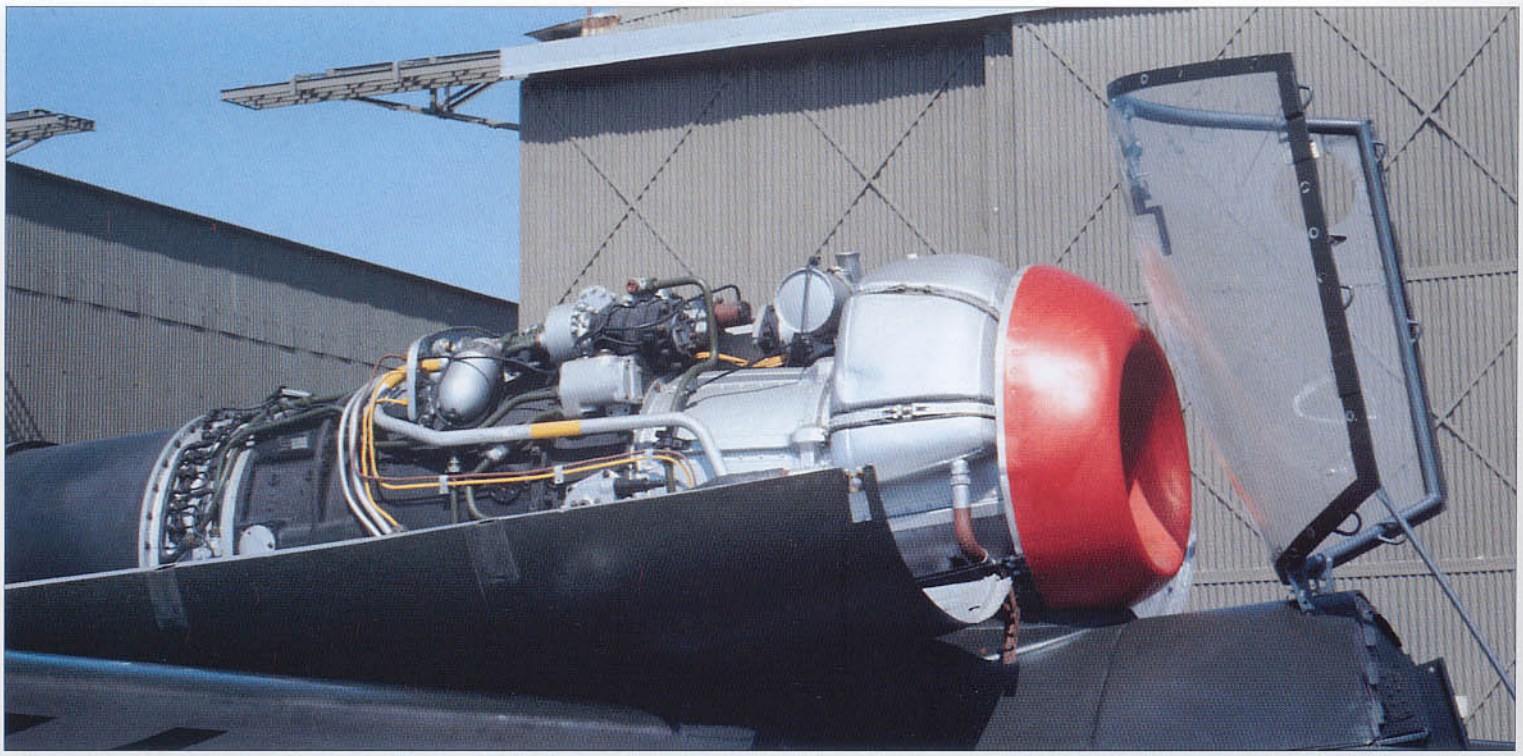




Opposite top: The aft section of the cockpit showing the padded back to the seat in position and the complete ejection seat removed. **Opposite bottom:** A view of the port side console showing the throttle quadrant holding the throttle, fuel shut-off lever (center) and undercarriage selector with its distinctive ring head. The undercarriage manual lowering handle is above and to the rear. The red pull handle (above the quadrant) is the undercarriage actuating mechanism. The red and black handle operates the flap hydraulics. **Above:** The fully restored cockpit of W.Nr. 120223.

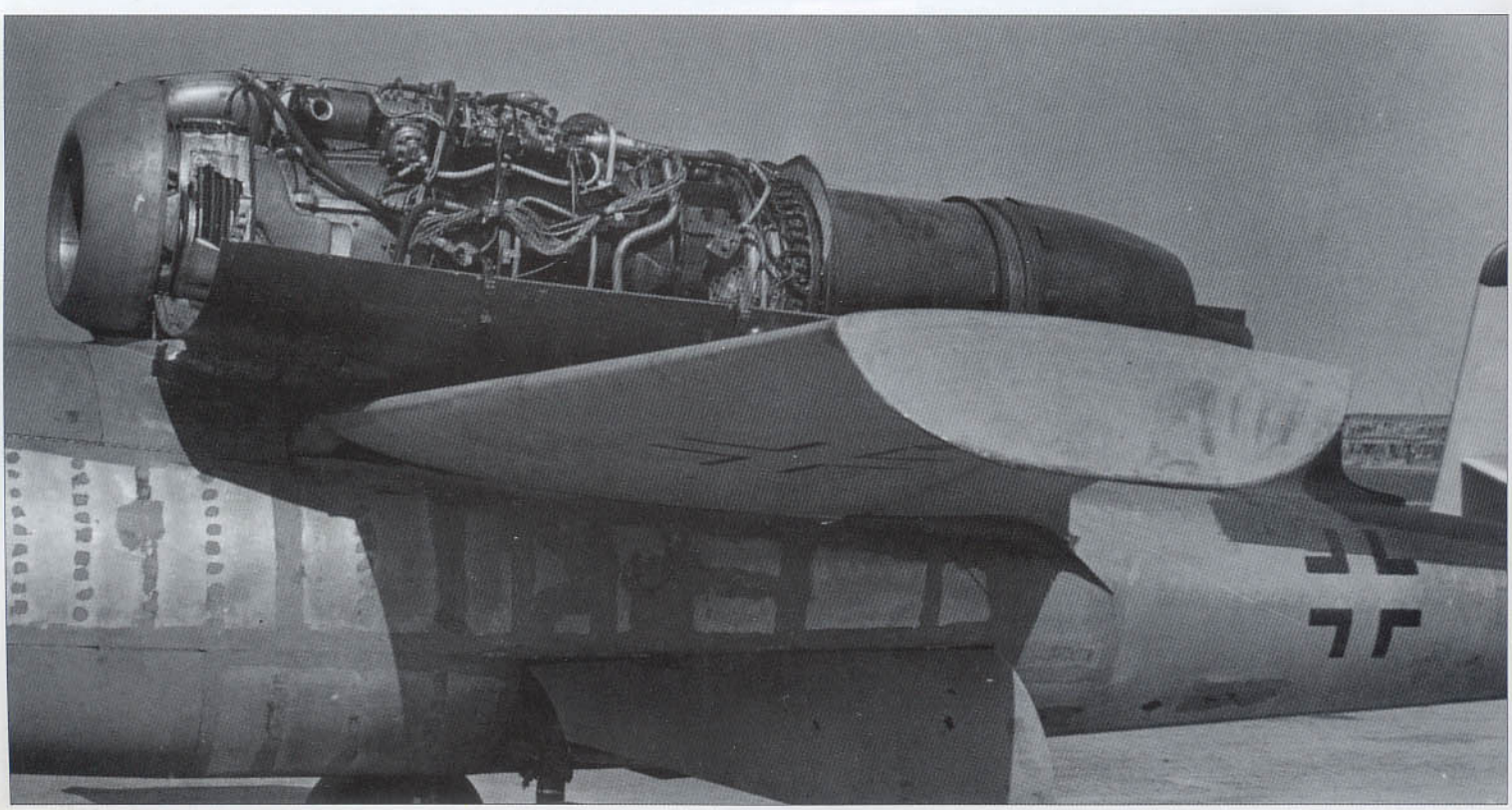
Below: The starboard side panel with the radio control box nearest the front. The rear section of the panel houses the starter switch and circuit breakers. The oxygen regulator unit above is not of German origin.

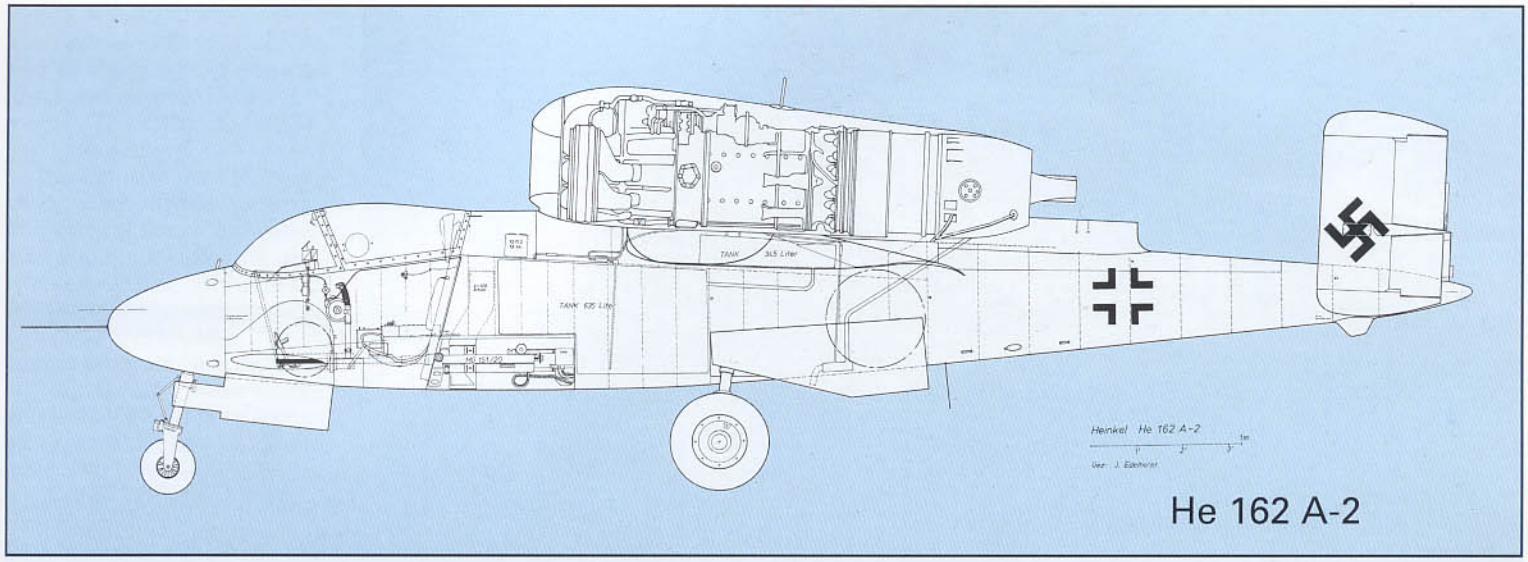


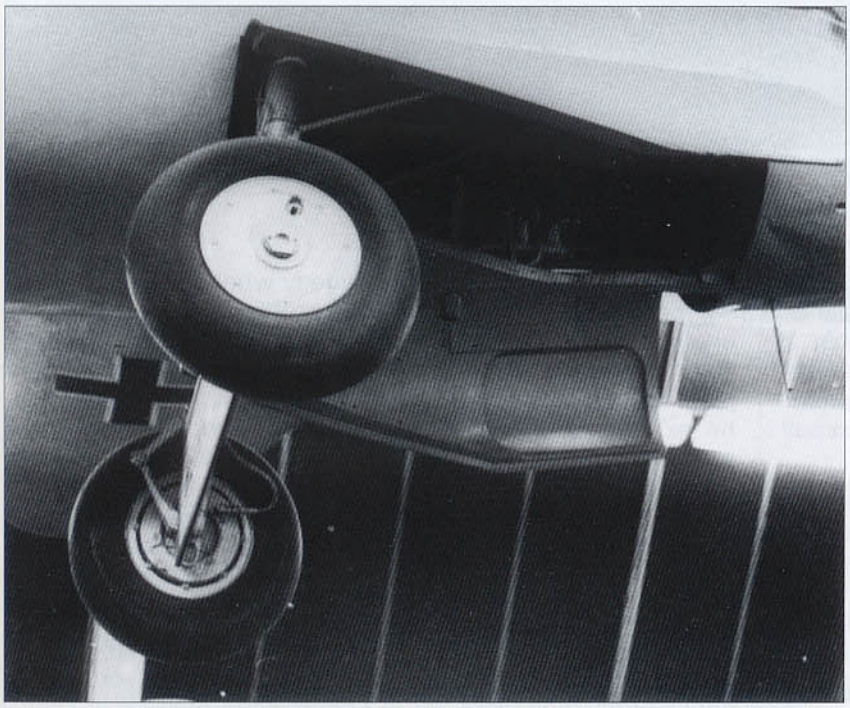


Above: The BMW 003 E-1 turbojet and engine accessories are exposed in this view of He 162 A- 2, W.Nr. 120227. Servicing the engine was made simple by the use of two clamshell covers. The red-colored cowling was actually part of the engine and not the airframe. Although attractive, the cowling ring was never painted in unit colors. It was either left in natural aluminum, or painted in the appropriate upper surface camouflage color (Color 82 Bright Green). The BMW 003 E-1 developed a takeoff thrust of 1,764 lb (800 kg) burning B4 or J2 aviation fuel.

Below: A close-up view of the port side of He 162 A-1, W.Nr. 300027, found at the Junkers Bernburg factory near Stassfurt showing the BMW 003 E-1 turbojet and accessories. As can be seen in this photograph, the aircraft was largely unpainted apart from the wing and portions of the rear fuselage. The Heinkel He 162 was manufactured in five locations within Germany. These centers included Heinkel North located at Rostock-Marienehe delivering aircraft with *werk nummern* (serial numbers) in the 120000 block, Heinkel South located at Vienna-Schwecht, building aircraft within the 200000 serial number block, Heinkel Hinterbrühl located in a vast underground complex near Vienna producing aircraft in the 220000 range of serial numbers, Junkers located at Bernburg manufacturing aircraft within the 300000 serial number block, and finally, the infamous underground Mittelwerke GmbH complex at Nordhausen delivered aircraft with serial numbers in the 310000 block.

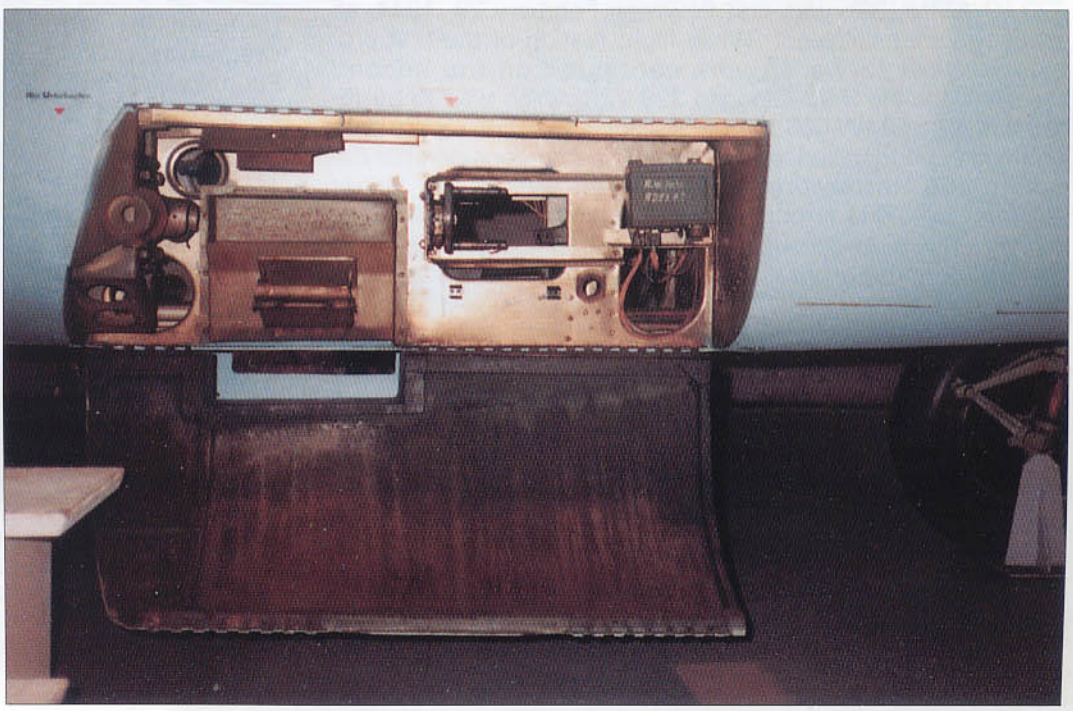


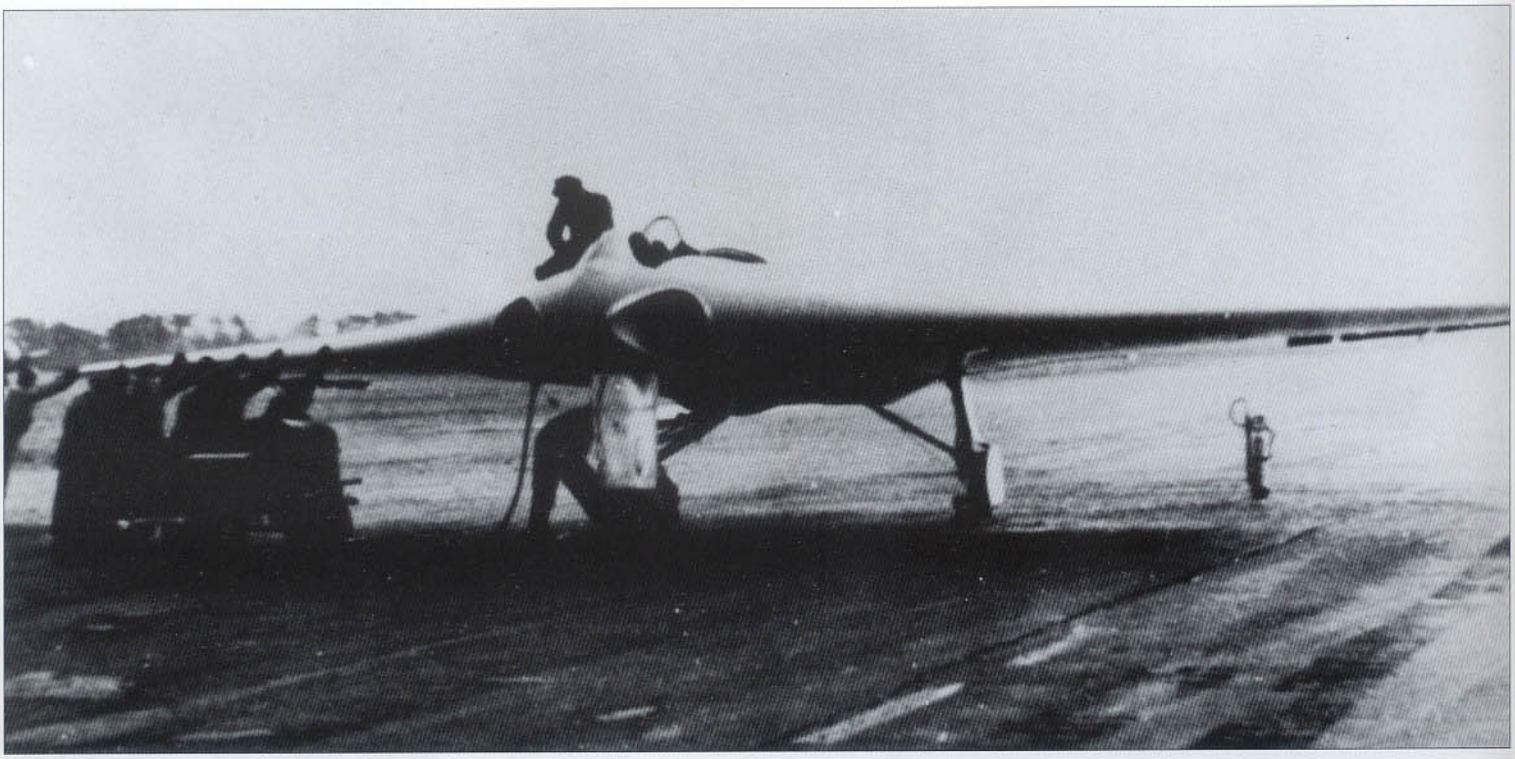




Above left and right: Two detail views of the landing gear of the He 162. The main wheels were extended by the use of two heavy-duty springs and retraced by hydraulic pressure. The main wheels were identical to those used by the Bf 109 K. Confirmation of the nose gear fully extending was achieved by the simple use of a small rod rising out of the nose cone just ahead of the canopy.

Right: The weapon bay for aircraft of the A-2 series armed with the 20 mm MG 151/20. Each of the two cannons carried 120 rounds, whereas the A-1 series, armed with the 30 mm MK 108, carried only 50 rpg.





Horten Ho 229 V2 & V3

Even if it had never flown, the sleek all-wing Horten Ho 229 gave the appearance of a radically different aircraft capable of great speed with outstanding performance. The fact that it began as a private venture without official government support in wartime Germany is remarkable enough, but the fact that it caught the attention and backing of *Reichsmarschall* Hermann Göring is even more unusual.

The concept called for an aircraft to be made largely of wood, but with a metal tubular center section covered by wood and metal. The pilot was to occupy an area between the two jet engines, with conventional seating beneath an aft-sliding canopy. A fully retractable landing gear was to be installed and provision was made for various armament combinations.

To test the concept, Reimer and Walter Horten designed and built the Ho 9 V1. This first prototype, also known as the Ho 229 V1 (W.Nr. 38), was first flown on February 28, 1944, as an unpowered sailplane. While flight testing of the first prototype went forward, work continued on the second machine, the Ho 9 V2 (also Ho 229 V2), which was to be fitted with two BMW 003 turbojets. However, these were destine not to be installed. Instead, after some considerable difficulty, the Horten brothers acquired two of the larger Junkers Jumo 004 turbojets for installation in the second prototype. Since these engines were substantially larger than the BMW units, a great deal of reworking was necessary. Finally, on December 18, 1944, the Ho 229 V2, W.Nr. 39, was flown for the first time at Oranienburg with *Leutnant (Lt.)* Erwin Ziller at the controls.

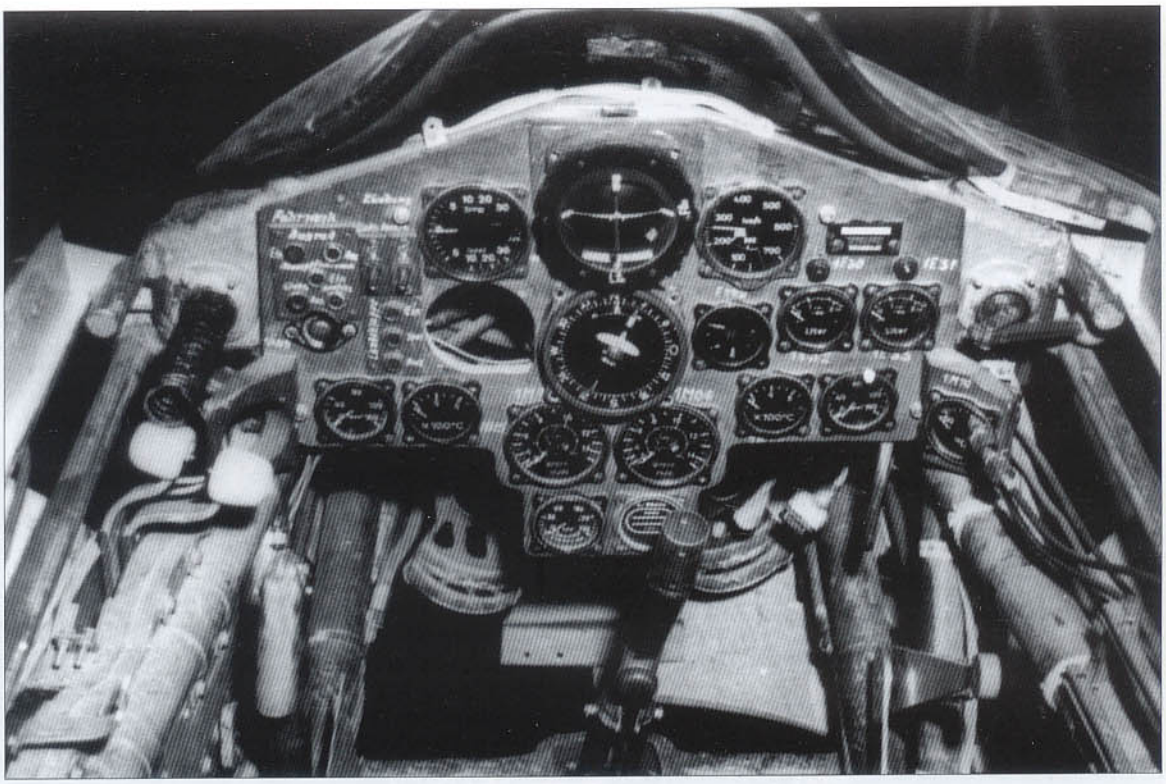
The first flight went well. No major problems were encountered in spite of the fact that the Horten brothers were unsure if all of the modifications made to the airframe might have lead to serious negative results. The first flight seemed to bode well for the project. Anxious to be with their parents for Christmas, the Horten brothers left Oranienburg for Göttingen, fully anticipating resumption of test flying after New Year's Day. However, because of circumstances beyond their control, they were not able to return, but they did give *Lt.* Ziller permission to carry out high-speed taxi runs with the Ho 229 V2.

Unfortunately, these ended in tragedy when *Lt.* Ziller crashed the prototype after encountering problems with one of the engines during an unauthorized flight. Ziller had supposedly taken to the air when he felt his brakes would not stop the jet in time during one of his high-speed runs. Once airborne, he experienced trouble in one of the Jumo 004s and prepared to return to base with only one jet working. During his approach, he then made several departures from procedure, which compounded his problems. Just before touch-down, the nose gear contacted an obstacle, causing the prototype to stall and crash onto the runway, trailing sparks and fragments of the airframe. Ziller died in the fiery crash and the prototype was completely destroyed.

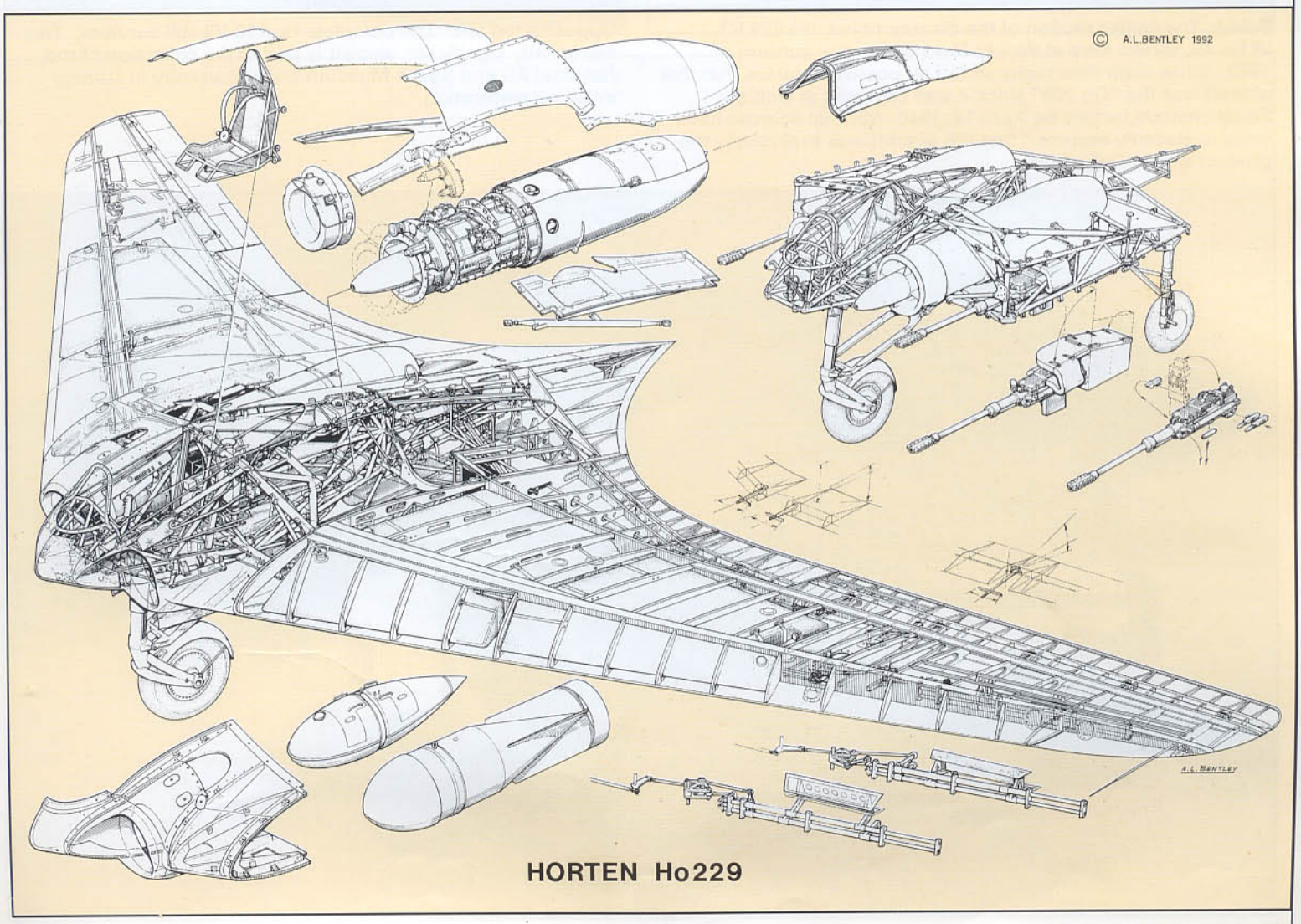
In January, 1945, in spite of the loss of the V2, orders for series production went out to Klemm and Gotha aircraft companies for a total of 93 Ho 229 A-1 jet fighters. Klemm was to build 40, and Gotha 53, aircraft. The Gothaer Waggonfabrik at Gotha began work on its 53 units in February, 1945. This company was also scheduled to build six additional prototypes (Ho 229 V3 through V8). The Ho 229 V3 was to serve as an instructional prototype for the Ho 229 A-1, and was about 90 percent complete when the war ended.

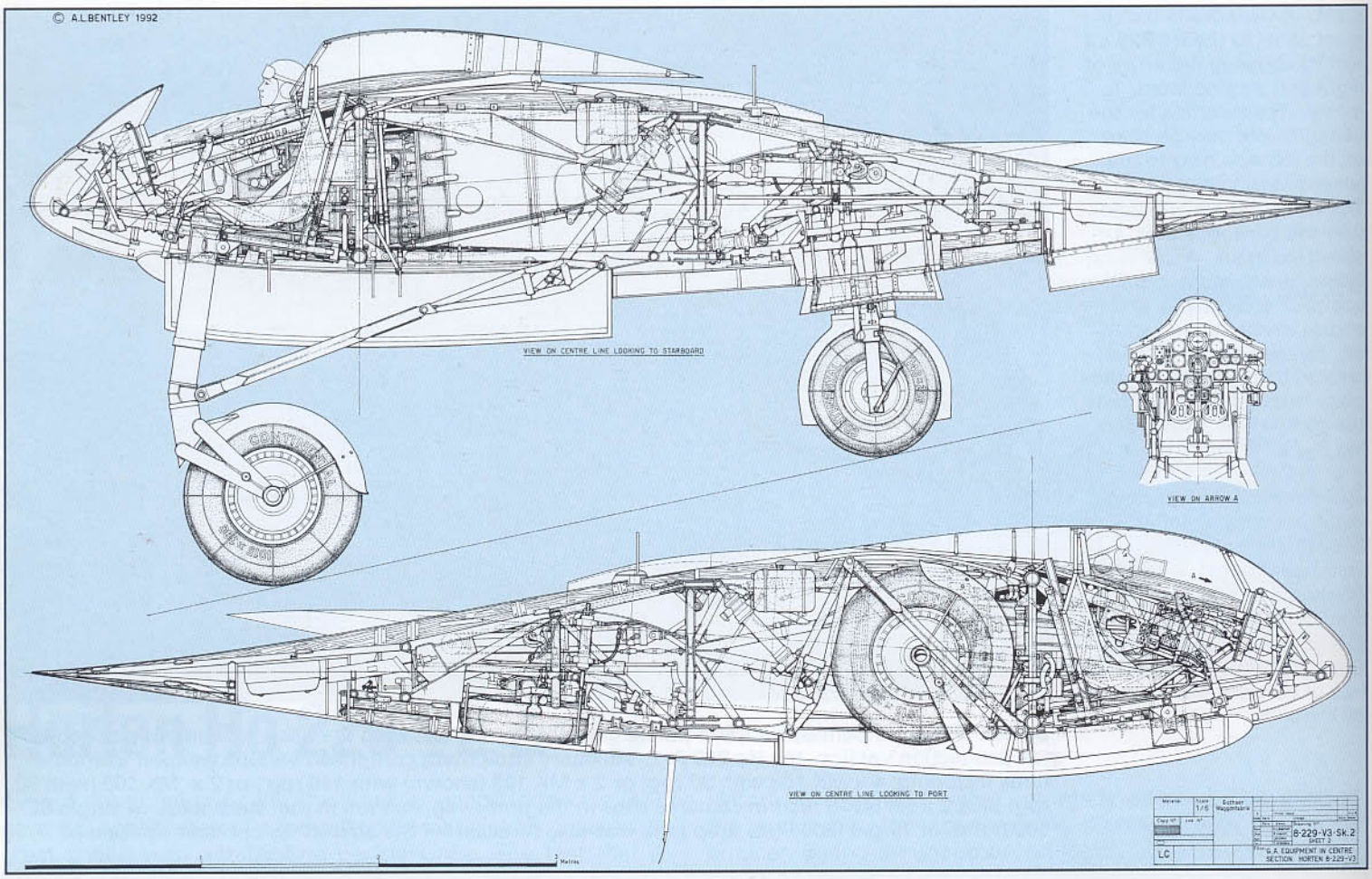
Above: Ho 229 V2, W.Nr. 39, the worlds first all-wing jet propelled fighter, being pushed into position on the runway at Oranienburg just prior to its first flight in December 1944. The man sitting above the starboard engine is a Junkers mechanic who was experienced at getting the two turbojets started. Test pilot *Lt.* Ziller, shown sitting in the cockpit, had not yet learned this procedure.

Right: A view of the instrument panel to the Ho 229 V2 and V3 showing the array of flight and engine instruments. The throttles for the two turbojets may be seen on the left side next to the canopy closing supports. The vertical speed indicator, turn and bank indicator, airspeed indicator, AFN2 blind landing instrument, repeater compass and the fine and course altimeter are included. Besides the noise level created by being only inches away from the two turbojets, the cockpit was drafty during flight. With the nose gear extended, the runway could be seen through the large opening directly beneath the area of the instrument panel. Added to this was the intended positioning of 30 mm cannons just beyond the engines. One can only imagine the lack of comfort experienced by the pilot!



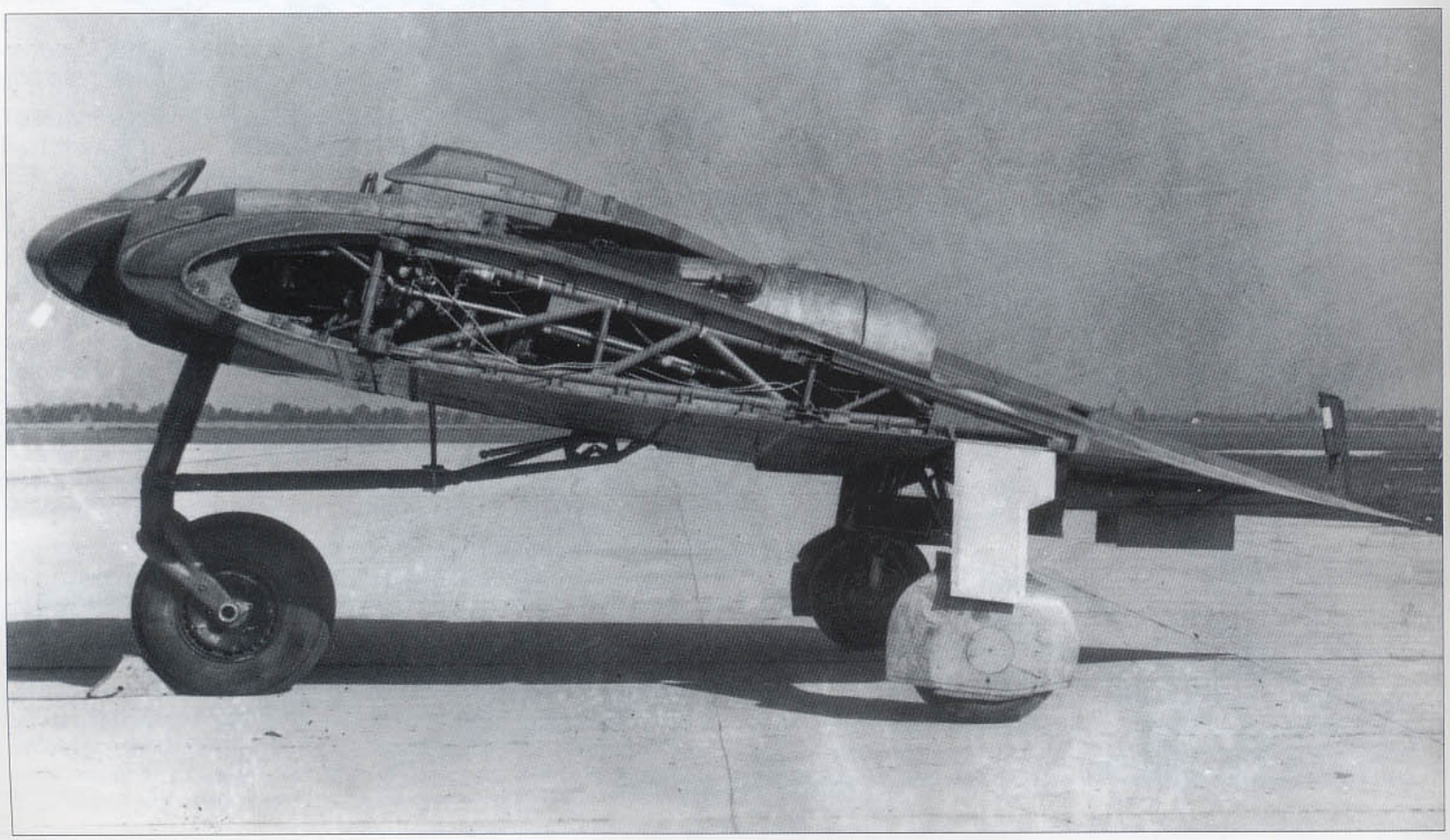
Below: Arthur L. Bentley's superb perspective illustration showing the basic equipment planned for the production version, the Ho 229 A-1. Auxiliary equipment comprised various weapon combinations including: 4 x MK 108 with 90 rpg, or 2 x MK 103 (shown) with 140 rpg , or 2 x MK 108 (with 90 rpg) plus 2 x Rb 50/18 reconn cameras (Rbs in the port wing, cannon in the starboard). A single SC 500 bomb or 79 gal (300 litre) drop tank was also forecast for the aircraft as optional equipment.

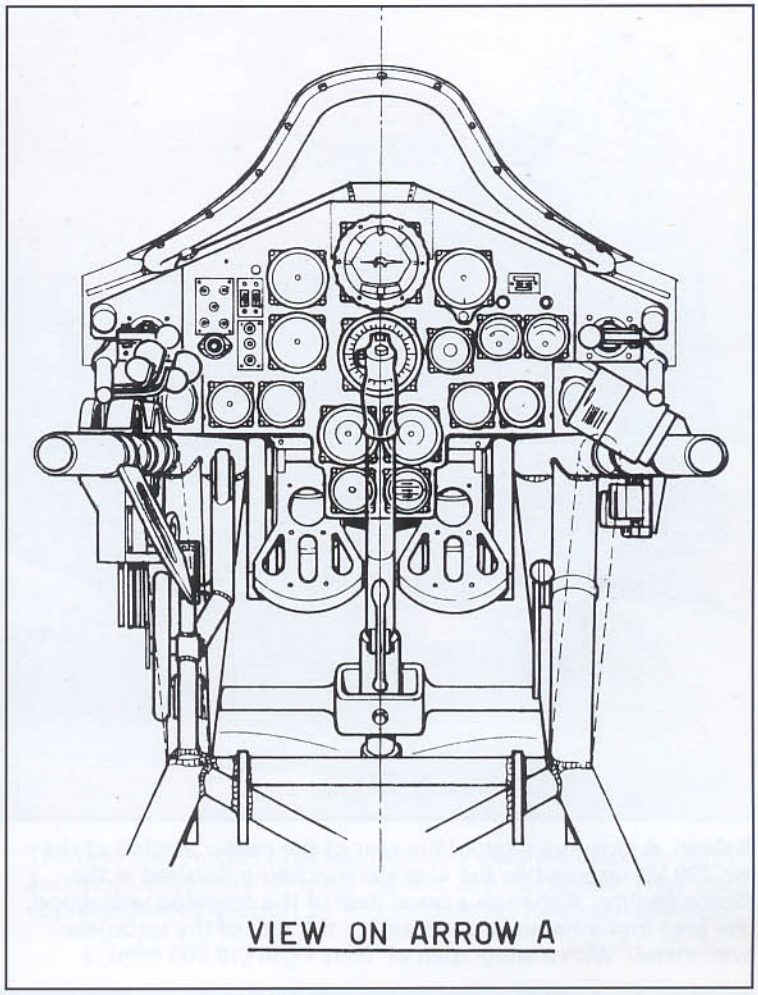




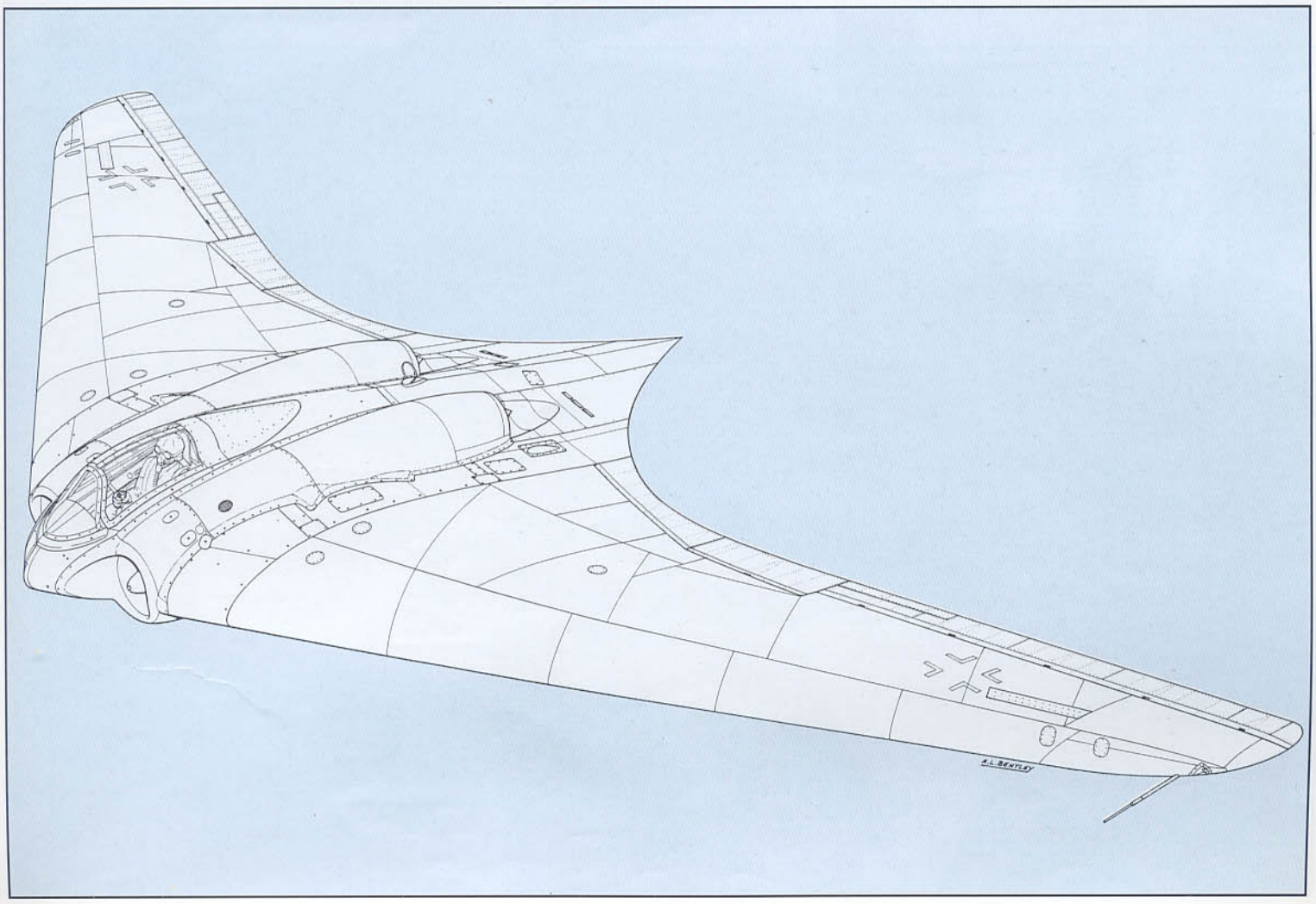
Below: The center section of the disassembled Ho 229 V3, W.Nr. 40, shown here at Wright Field during the autumn of 1945. It has been incorrectly stated by postwar sources that this aircraft was the "Go 229" since it was captured at Gotha's Friedrichsrode factory on April 14, 1945. Various sources have since mistakenly assumed that the aircraft was exclusively the product of the Gotha firm.

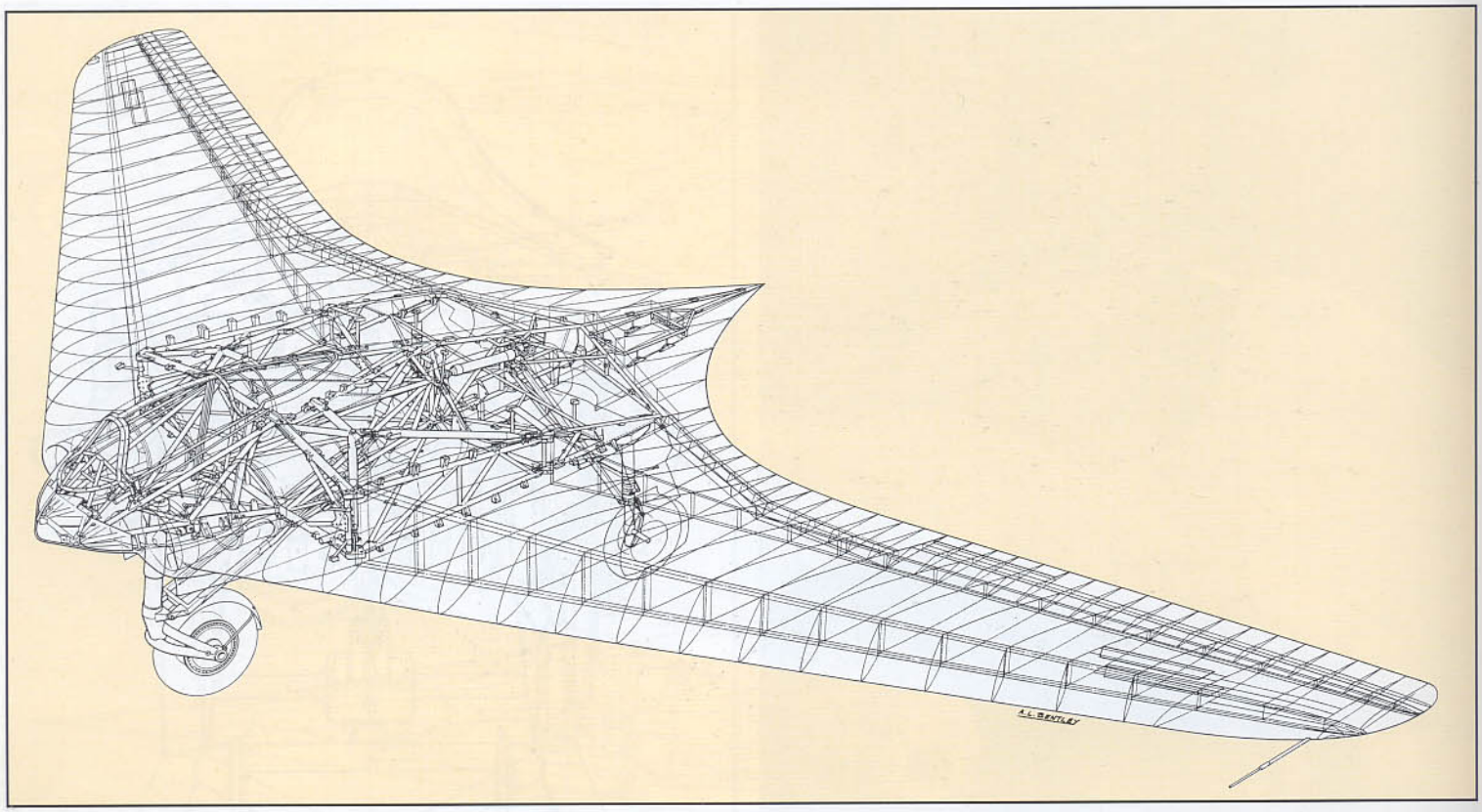
Opposite top left: The complete Ho 229 V3 still survives. This historically significant aircraft is part of the collection of the National Air and Space Museum and is currently in storage awaiting restoration.



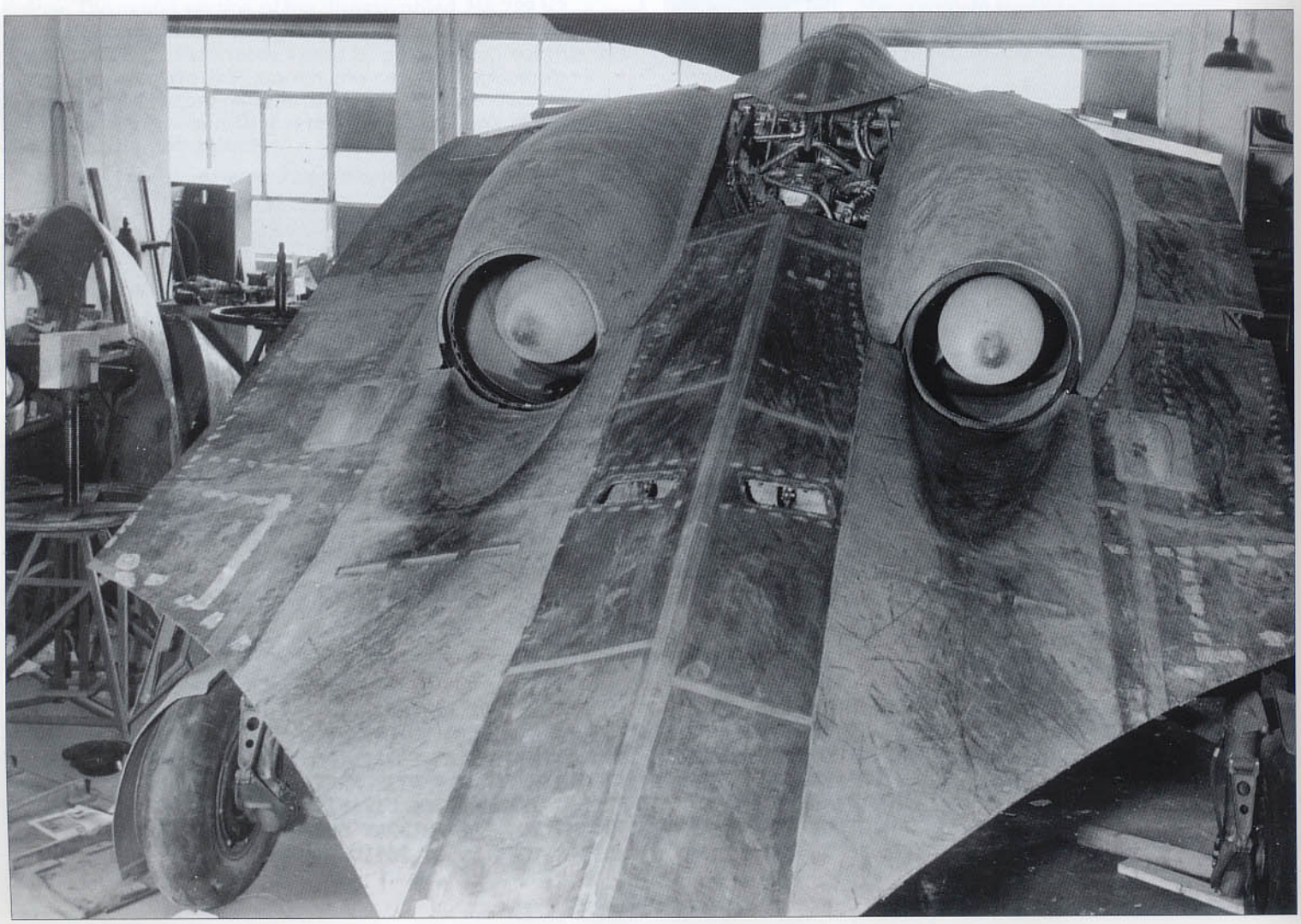


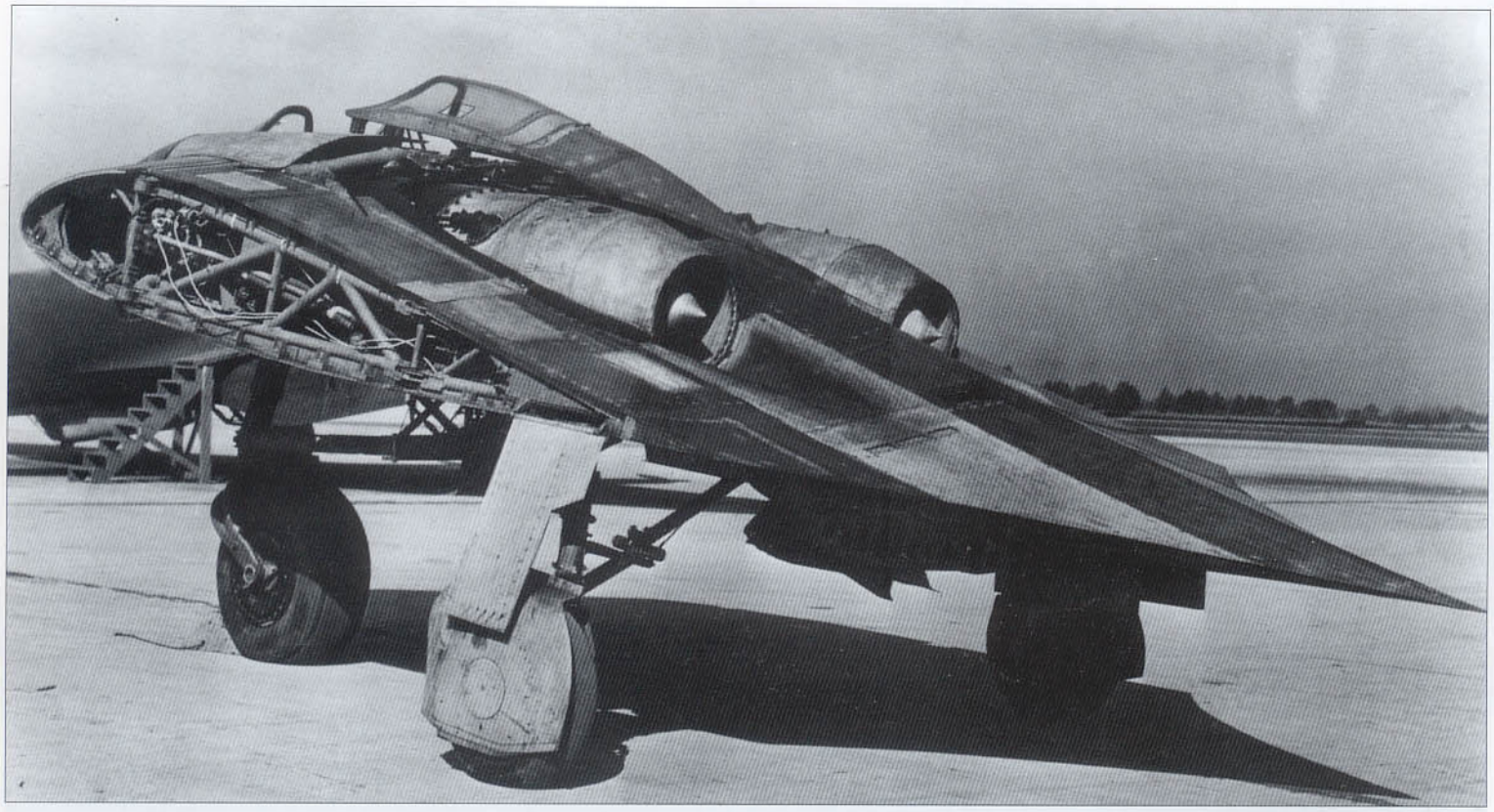
VIEW ON ARROW A





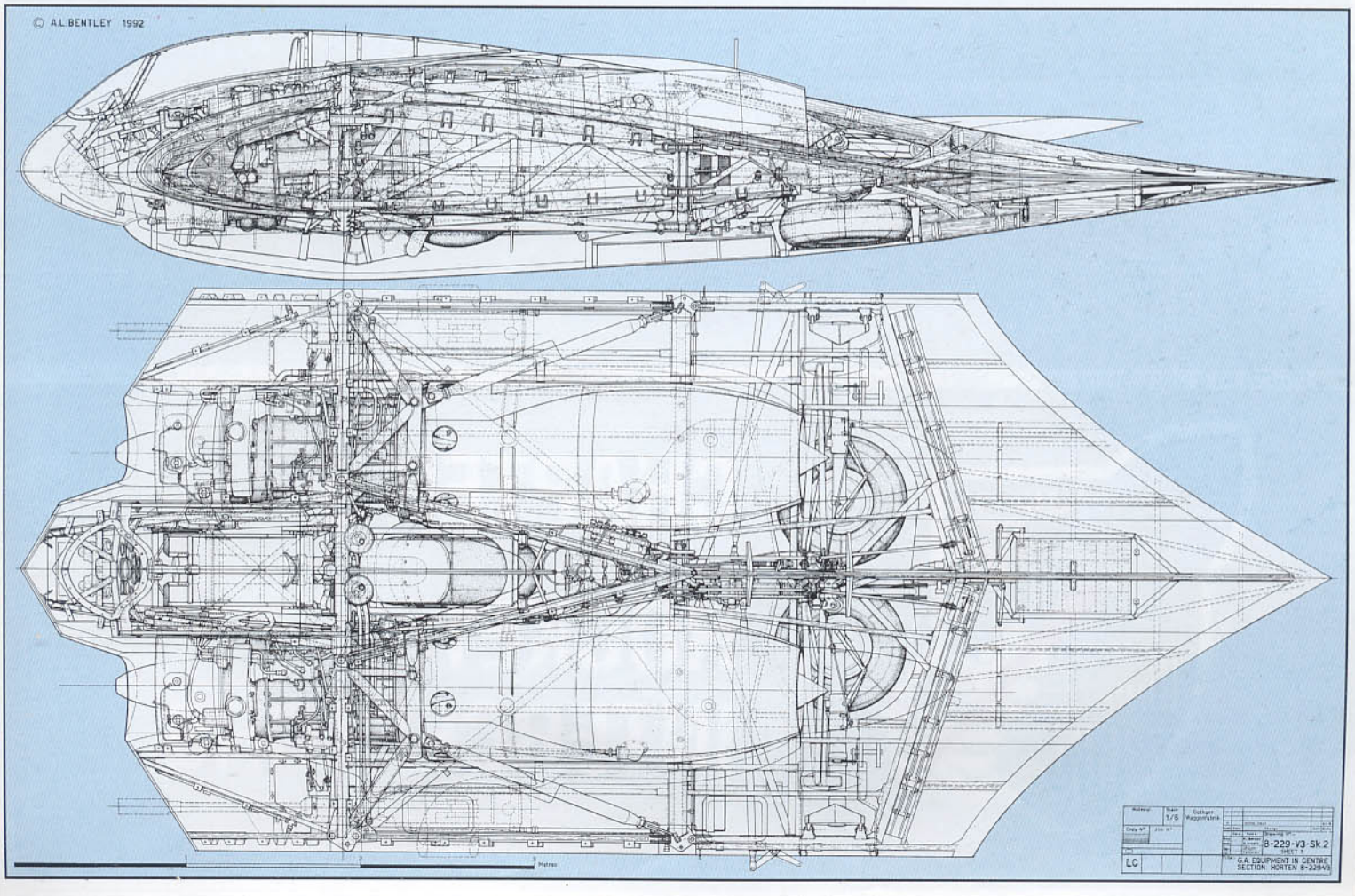
Below: A close-up view of the rear of the center section of the Ho 229 V3 taken while the aircraft was being finished at the Gotha facility. Although a good deal of the covering was wood, the area immediately around and to the rear of the turbojets was metal. With a wing span of 55 ft 1 3/8 in (16,800 mm), a length of 24 ft 6 in (7,465 mm), a height of 9 ft 2 3/4 in (2,810 mm), a takeoff weight of 19,840 lb (8,999 kg), and an anticipated maximum of speed of 607 mph (977 km/h) at 39,372 ft (12 km), the Horten fighter would have been impressive for its day.

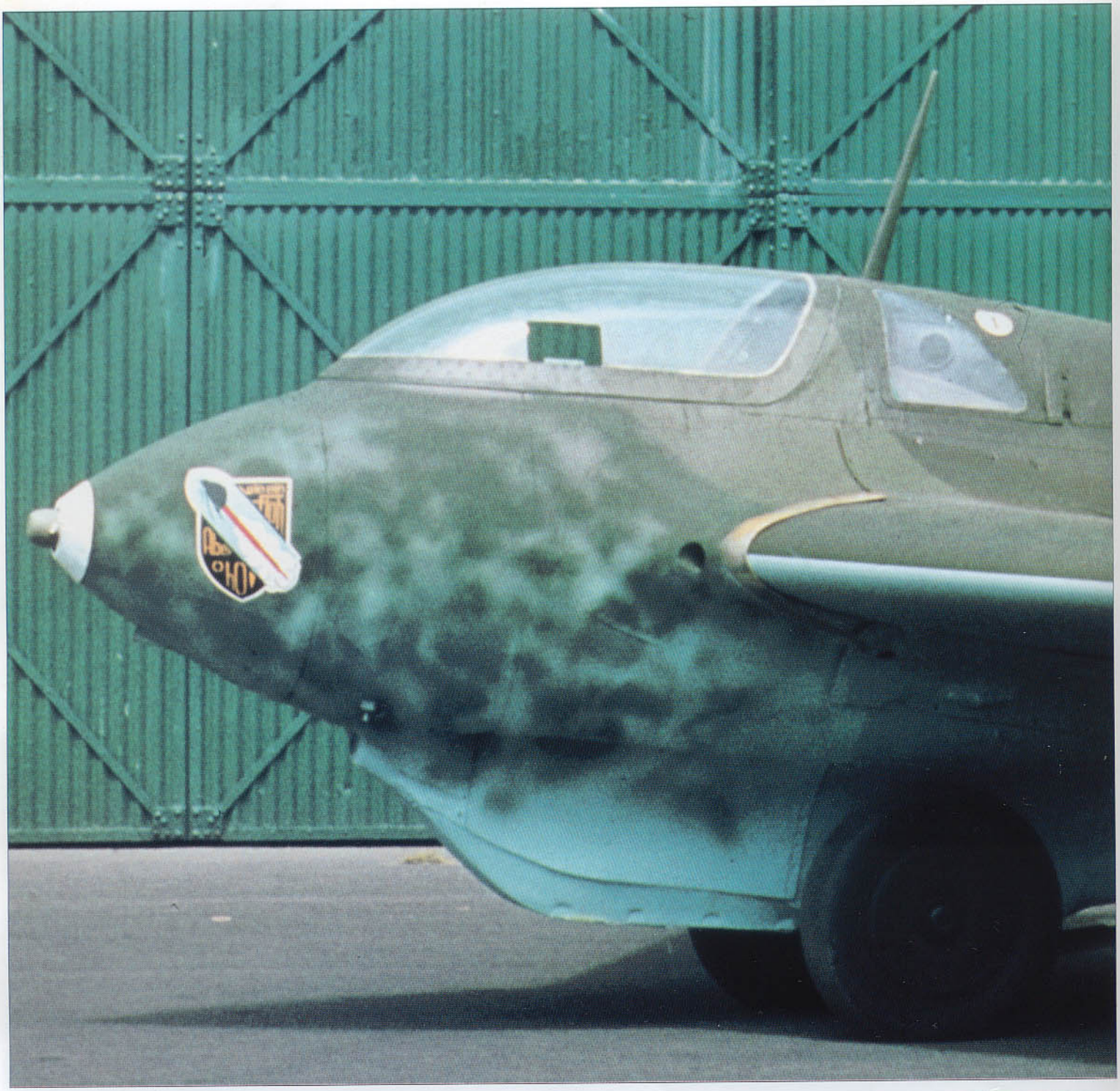




Above: Another view of the Ho 229 V3 taken at Wright Field where it became Foreign Equipment number FE-490 (later T2-490). Note the open doors at the rear of the center section. This area was reserved for the braking parachute...another innovation of the all-wing fighter. As advanced as the Ho 229 was, it was considered only a beginning in the field of all-wing aircraft.

The talented Horten brothers had very detailed plans for larger, and more advanced all-wing fighters and bombers. They also enjoyed the full support of *Reichmarschall* Hermann Göring.





CHAPTER 5

ROCKET INTERCEPTORS

Messerschmitt Me 163 B-2

The Me 163 was designed as a target-defense interceptor; not a fighter plane. Its mission was to intercept and attack Allied bombers before they reached their intended targets. To carry out this mission the *Komet* (Comet), as it was called, relied upon its phenomenal rate of climb and its heavy-caliber cannons. It was propelled by a rocket engine and incorporated a number of unusual features.

Building on experience gained with earlier rocket-driven types, such as the DFS 194 and the Me 163 A, design of the Me 163 B began in 1941. Construction of the first prototype for the B-series, the Me 163 B V1, began during autumn, 1941. It was powered by the new Walter HWK 509 A-2 bi-fuel liquid rocket engine using C-Stoff (hydrazine hydrate and water in methanol, with small traces of sodium cuprocyanide as a catalyst), and T-Stoff (hydrogen peroxide) as fuels. T-Stoff was contained in two 15.8 gal (60 ltr) tanks located on either side of the cockpit plus one large 274.7 gal (1,040 ltr) fuselage tank immediately aft of the cockpit. C-Stoff was contained in two 19.3 gal (73 ltr) tanks located in the inboard section of the wing's leading edge. Two additional C-Stoff tanks of 45.7 gal (173 ltr) were installed within the inboard section of each wing. Total fuel capacity for T-Stoff was 306.3 gal (1,160 ltr) with a total of 130 gal (492 ltr) for C-Stoff. With this fuel load, running time for the rocket engine was 8 to 10 minutes. Maximum speed of the Me 163 B was 595 mph (957 km/h) at operating altitude.

The Me 163 B could reach an altitude of 39,000 feet (11,887 m) in 2.6 minutes. Upon reaching an altitude slightly higher than the target, the *Komet* pilot would cut the engine and glide down to make his firing pass. Upon reaching a lower altitude, he would restart his rocket to regain sufficient altitude for another pass. This procedure was followed until all fuel was consumed. The pilot then began his unpowered decent as a glider.

The Me 163 B was equipped with a two-wheeled jettisonable dolly mounted to the under-fuselage landing skid. Upon take-off, the dolly was immediately released once the *Komet* reached an altitude of approximately 30 feet (9 m). During his approach to land, the *Komet* pilot lowered the central skid and landed on the unpaved portion of the airfield. After sliding along the ground for a considerable distance, the aircraft gently came to rest on one of the small wing-tip skids. A special wheeled vehicle with a fork lift was required to retrieve and remount the aircraft onto the two-wheeled dolly.

Standard armament for the Me 163 B consisted of two 20 mm MG 151/20 cannons for the first 45 preproduction aircraft, the Me 163 B-0 V1 to V45. From preproduction aircraft Me 163 B-0 V46 to V70, and all subsequent B-series *Komets*, two 30 mm MK 108 cannons with 60 rpg were mounted within the wing roots. However, due to the slow rate of fire of the MK 108, coupled with the rapid closing speed to intercept a much slower-flying target, the *Komet's* pilot had only a few seconds to line-up and fire his weapons before evasive action had to be taken to avoid collision.

The first *Komets* reached the *Luftwaffe* in May, 1944, and were issued to Erprobungskommando 16 based at Bad Zwischenahn for the purpose of testing and evolving tactics. The first encounter of the *Komets* with Allied aircraft occurred on July 28, 1944. Soon thereafter, a new unit was activated to operate the *Komet*, JG 400. Total production of the Me 163 B amounted to 364 aircraft.

Opposite left: This close-up of the nose and cockpit section of Me 163 B-2, W.Nr. 191904, which was beautifully restored in Britain in the late 1970s, thoroughly captures the essence of this remarkable aircraft.

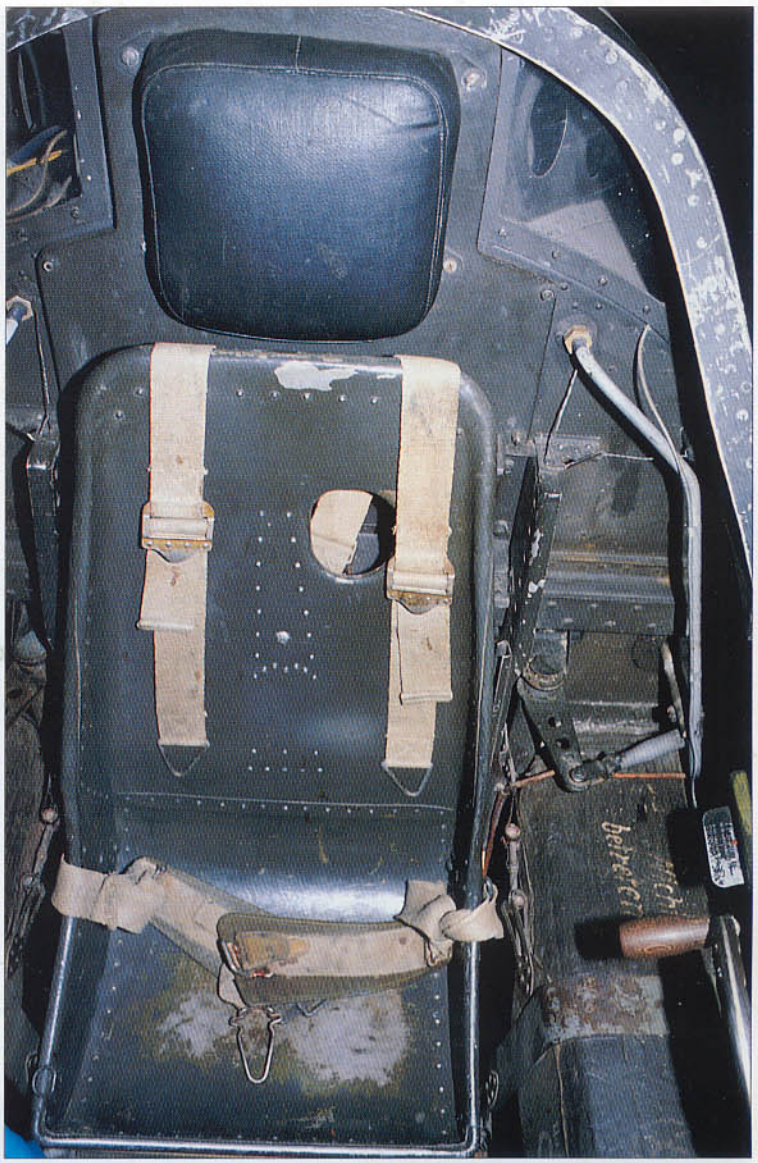
Above: Me 163 B-2, W.Nr. 191301, photographed in Philadelphia, Pennsylvania, during 1950 bearing Foreign Equipment number FE-500 (also T2-500). This particular *Komet* toured many American cities in conjunction with various Armed Forces displays during the 1950's. However, by 1954 it was declared surplus and given to the Smithsonian Institution. It is currently unrestored and on limited public display at the National and Air Space Museum's Silver Hill, Maryland facility.

Left: A view of the 90 mm armored glass inner windscreen of the Me 163 B-2, W.Nr. 191907, held by the Australian War Memorial, during its restoration. Missing are the Revi 16 B gunsight from the top center of the instrument panel, the variometer in the top right corner of the independently sprung blind flying panel, the rpm counter in the lower center and the fuel consumption indicator in the lower right section of the main panel.

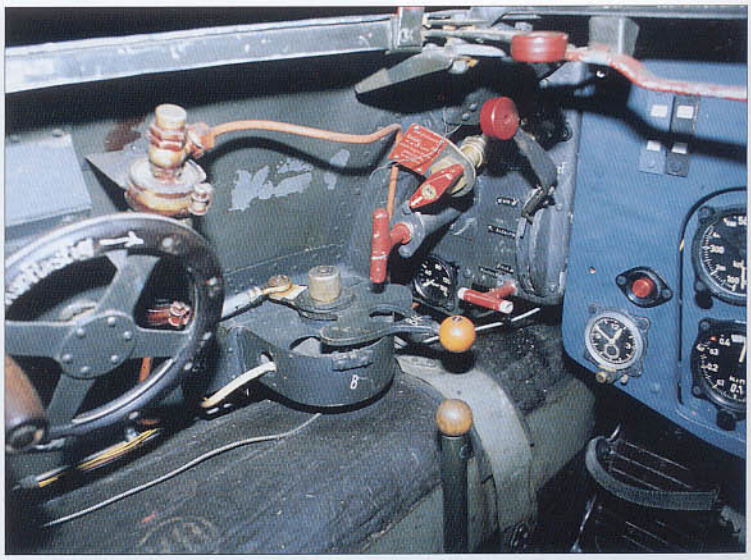
Opposite top right and left: Two views of the pilot's seat showing the seat and shoulder belts in position.

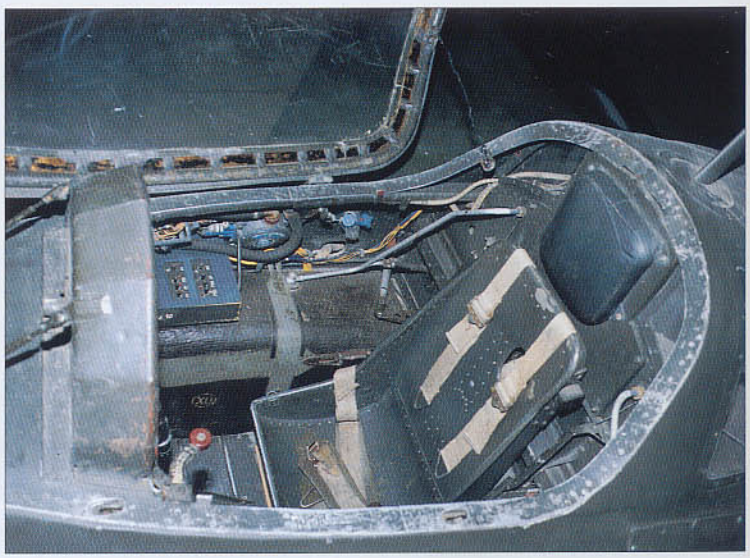
Opposite bottom: A view of the port side of the cockpit, in its original wartime colors, reveals the cramped nature of the design.

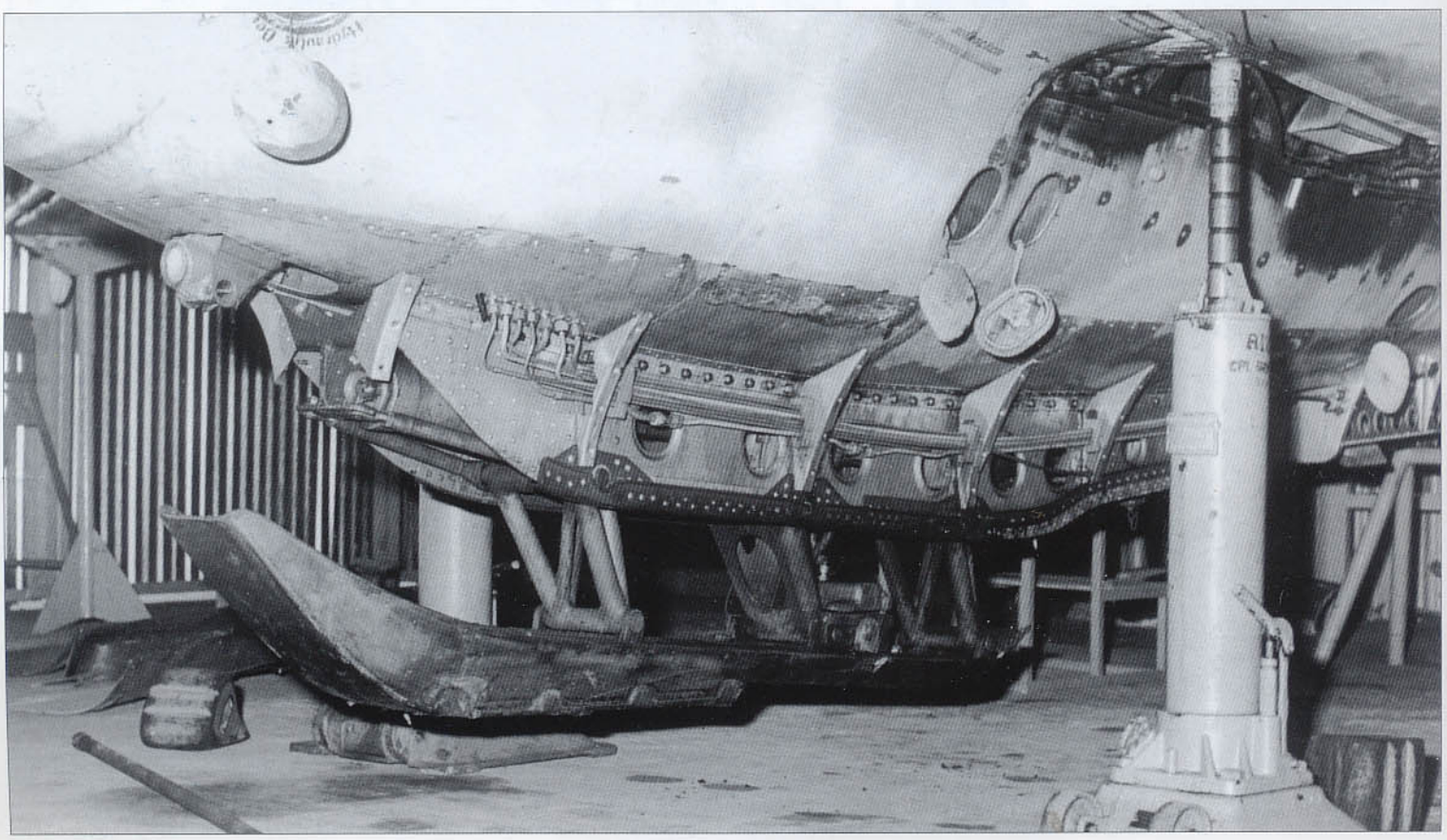
1. T-Stoff fuel tank
2. Auto return by-pass line
3. Oil reservoir for flaps
4. Universal on shaft to flap trim
5. Trim control box
6. Trim position indicator
7. Tables for towed and powered start
8. Trim hand wheel
9. Oil pressure reservoir
10. Flap lever
11. Flaps hand pump
12. Fire warning horn
13. Throttle daudrant box
14. Throttle
15. Throttle limiting vernier
16. Starter switch
17. Throttle torque thrust link
18. Landing skid compressed air gauge
19. Jettison handle for tow coupling
20. Landing skid + tail wheel position selector handle
21. Valve for skid selector
22. Compressed air pressure gauge
23. Emergency fuel jettison hand grip
24. Canopy locking handle
25. Canopy release handle
26. Armor plate glass
27. Cabin air vent
28. Magnetic main compass
29. Revi 16B gunsight
30. Revi-compass bracket
31. Compass deviation card
32. Radio frequency selector switch
33. FuG 25a control box
34. Radio control knob
35. Arming switches and round counters
36. Main instrument panel
37. Left secondary panel
38. Undercarriage indicator
39. Master cut-out switch
40. Chronometer
41. Thrust gauges
42. Temperature gauges
43. Airspeed indicator
44. Artificial horizon + turn and bank
45. Variometer
46. Oxygen on disc indicator
47. FuG 16 Z frequency band knob
48. Blind flying panel
49. Low fuel warning lamp
50. Fine and coarse altimeter
51. Tachometer
52. Fuel consumption indicator
53. KG 12 E control grip
54. MK 108 cannon arming button
55. Oxygen flow indicator
56. Right secondary panel
57. Oxygen flow regulator valve
58. Oxygen pressure gauge
59. Radio panel
60. Emergency canopy release
61. Oxygen tube
62. Radio plug for pilotís helmet
63. Oxygen regulator

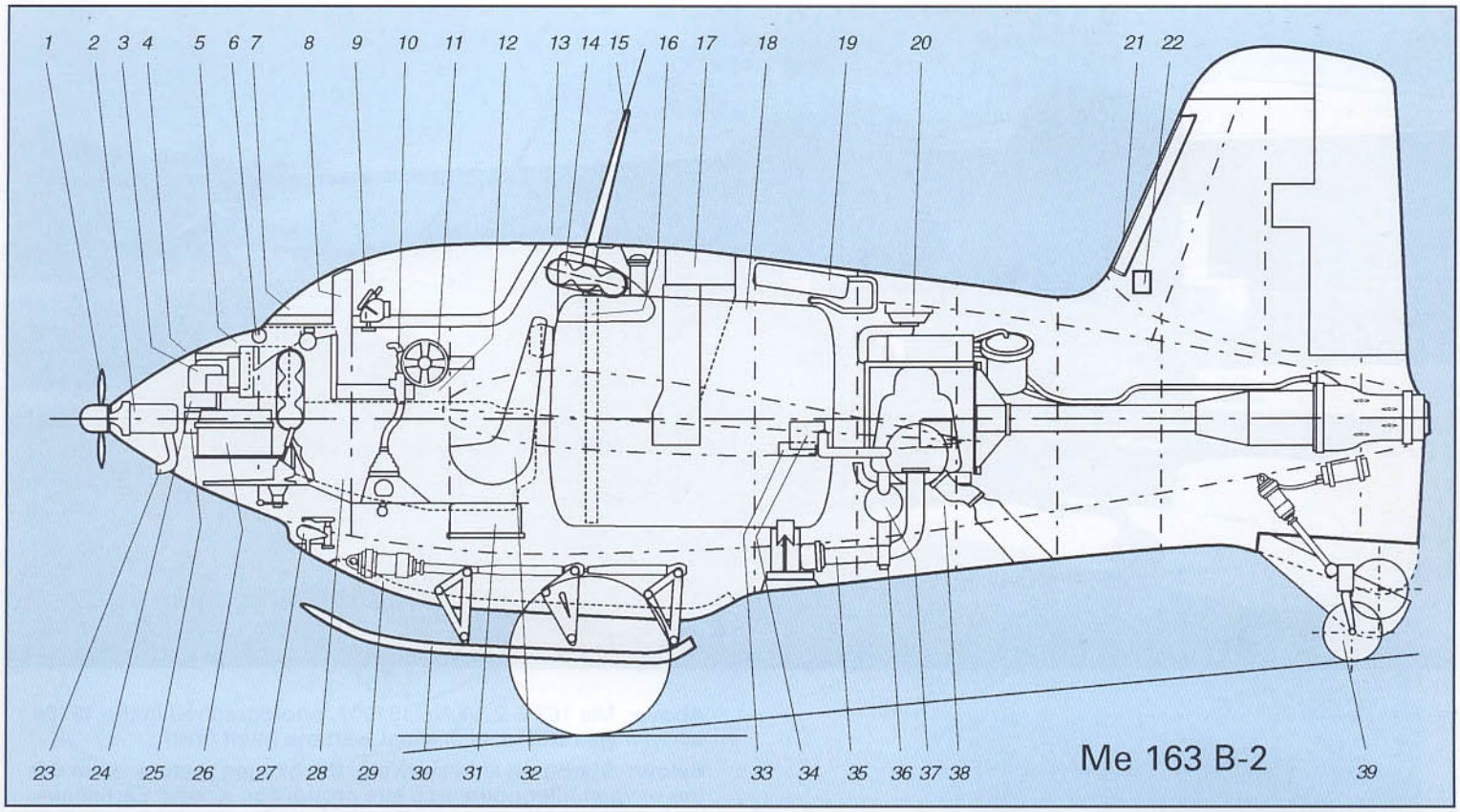


Next page: Three more color photographs of the Australian *Komet* showing details of the lower cockpit, starboard console and a close-up of the area around the throttle (with orange-yellow ball). The bottom photograph, also of the Australian *Komet*, shows the heavy keel structure which supported the landing skid mechanism. Note the hydraulic lines to the cockpit run along the side of the keel.

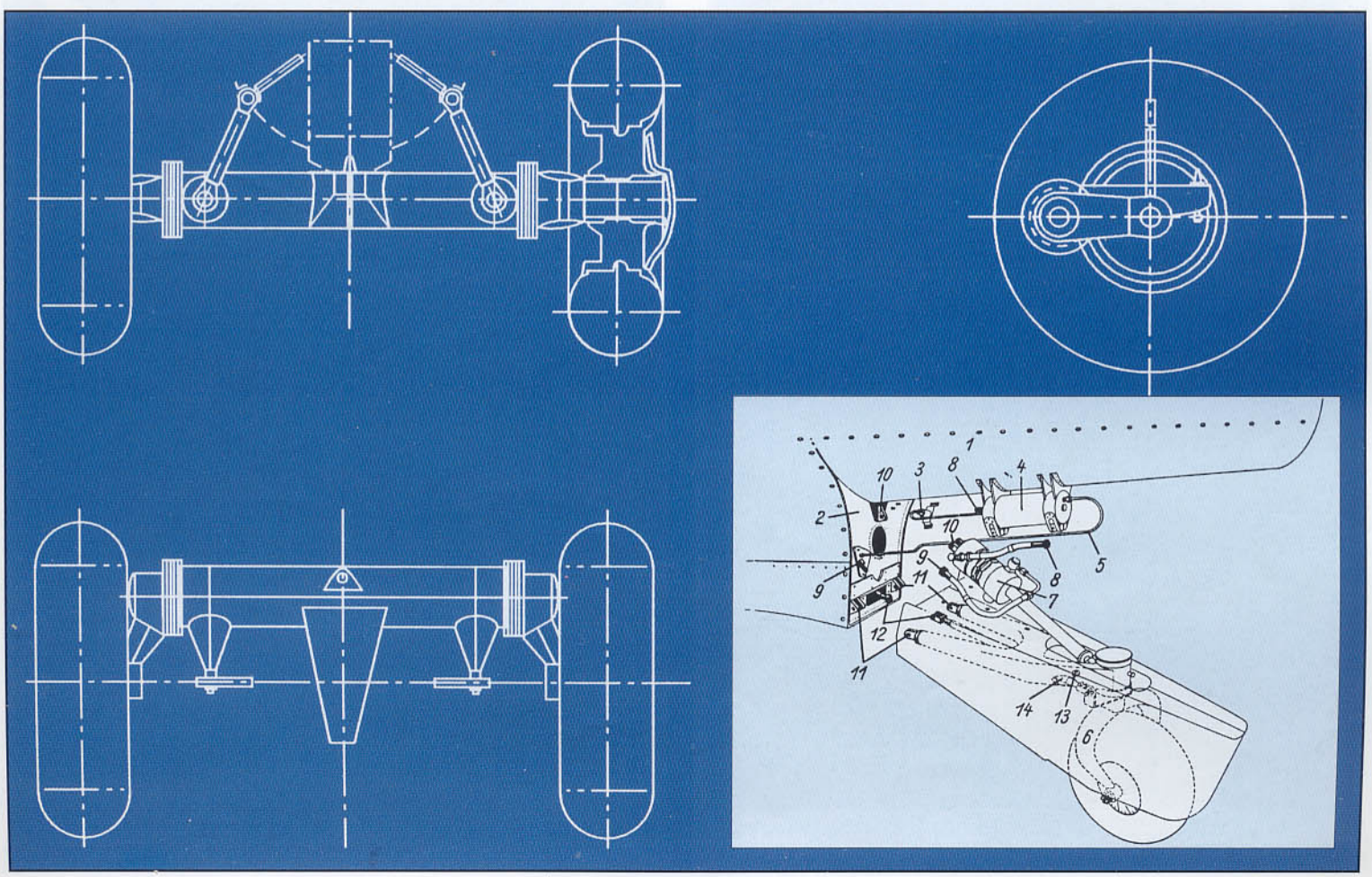


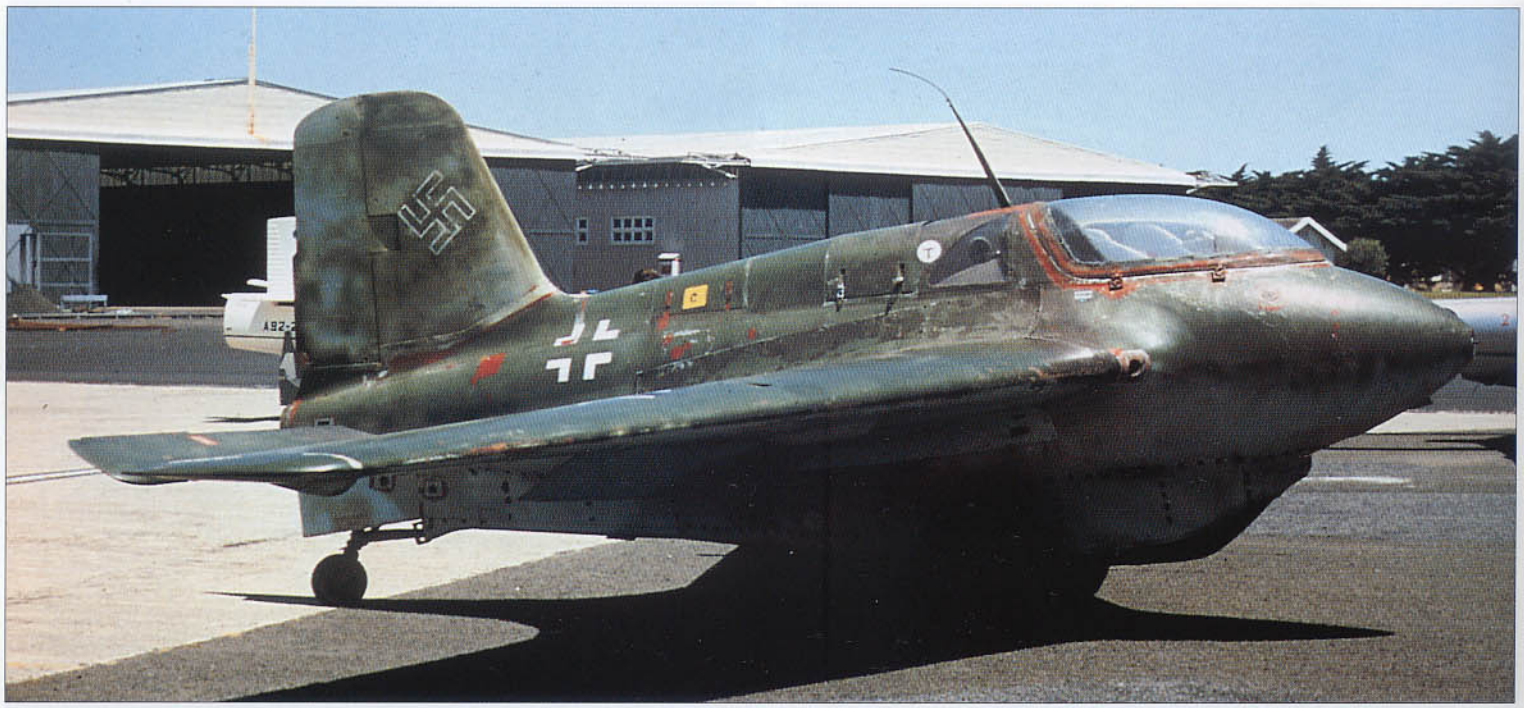






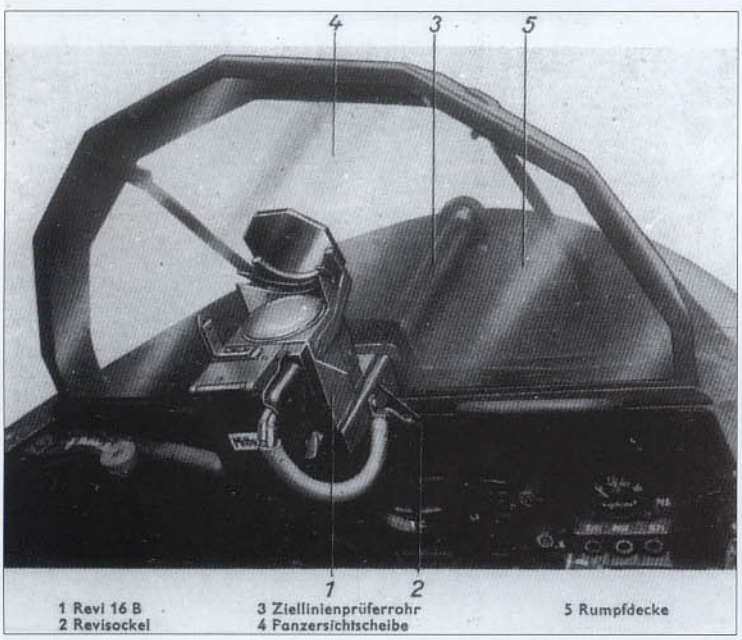
1. Electrical generator prop
2. Generator
3. FuG 16 ZE receiver
4. Rudder pedals
5. FuG 16 ZE radio
6. Expansion tank for variometer
7. Instrument panel
8. 90 mm armored glass
9. Revi 16 B gunsight
10. Control column
11. Trim control
12. Equipment console
13. Bosch warning horn
14. Oxygen container
15. Radio antenna mast
16. Fuel delivery tube
17. Ammunition belt feed
18. T-Stoff fuel tank
19. Intermediate tank
20. Filler point for C-Stoff
21. Energizing cover for FuG 16 ZE
22. Antenna adjustemnt unit for FuG 16 ZY
23. Suction scoop for generator cooling
24. Interference suppressor
25. Radio regulator
26. Battery
27. Tow bar hook
28. T-Stoff fuel tank
29. Compressed air ram for skid
30. Landing skid
31. FuG 25a
32. Pilot's seat
33. Electric charging switch box
34. Cutout distribution box
35. Quick fuel dump
36. Pressure tube line for C-Stoff
37. Accelerator tank
38. Distribution box
39. Tailwheel



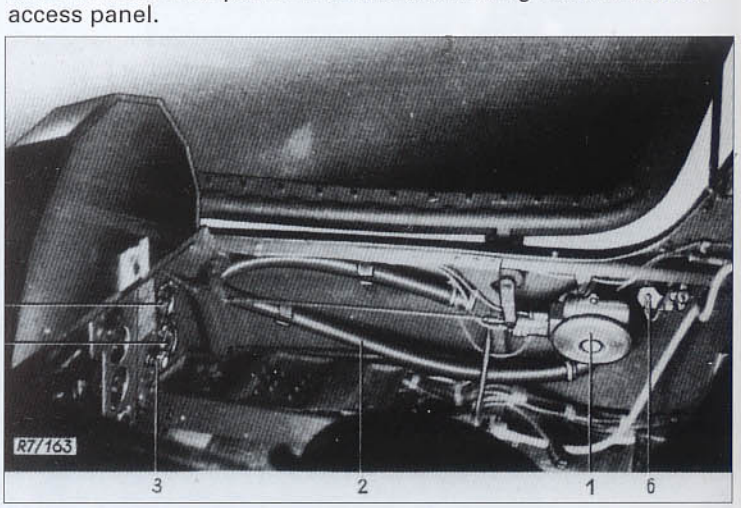


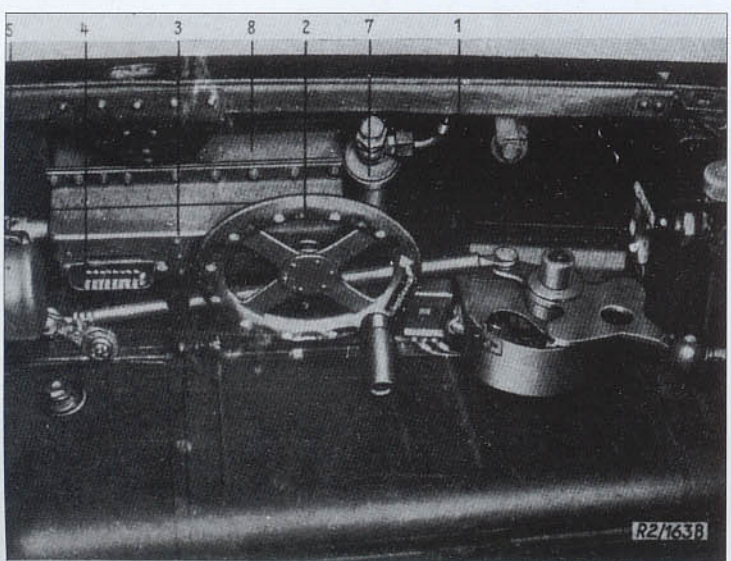
Above: Me 163 B-2, W.Nr. 191907, photographed in the 1970s when it was still in its original wartime paint finish.

Below: Starboard side showing the oxygen system. Item 6 is the oxygen filler point on a late production *Komet*. Earlier aircraft had the filler point in the starboard wing root beneath an access panel.

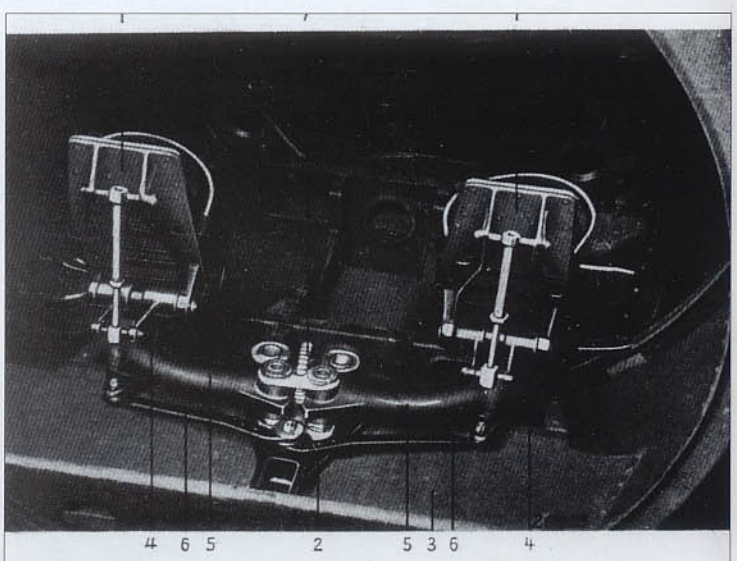


1 Revi 16 B
2 Revisockel
3 Zielinienprüferrohr
4 Panzersichtscheibe
5 Rumpfdecke

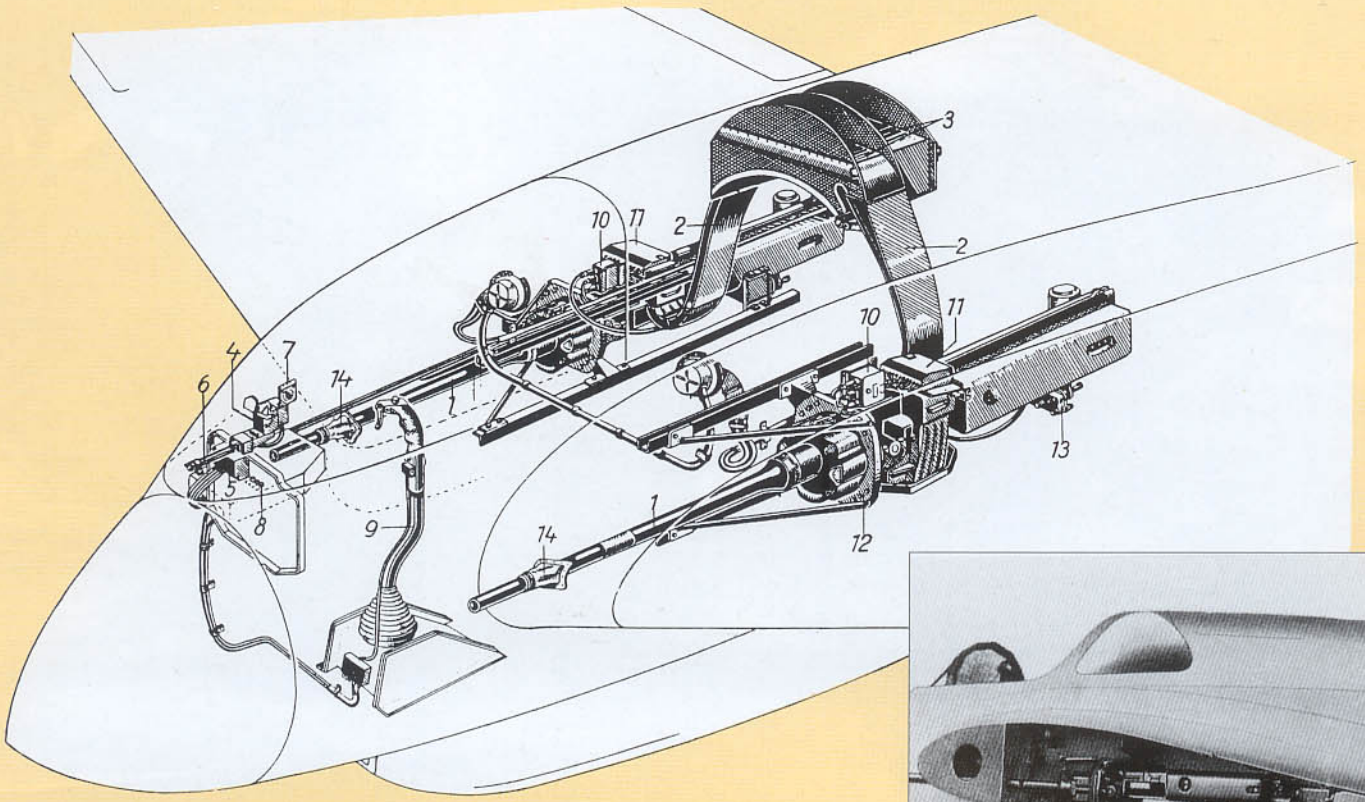




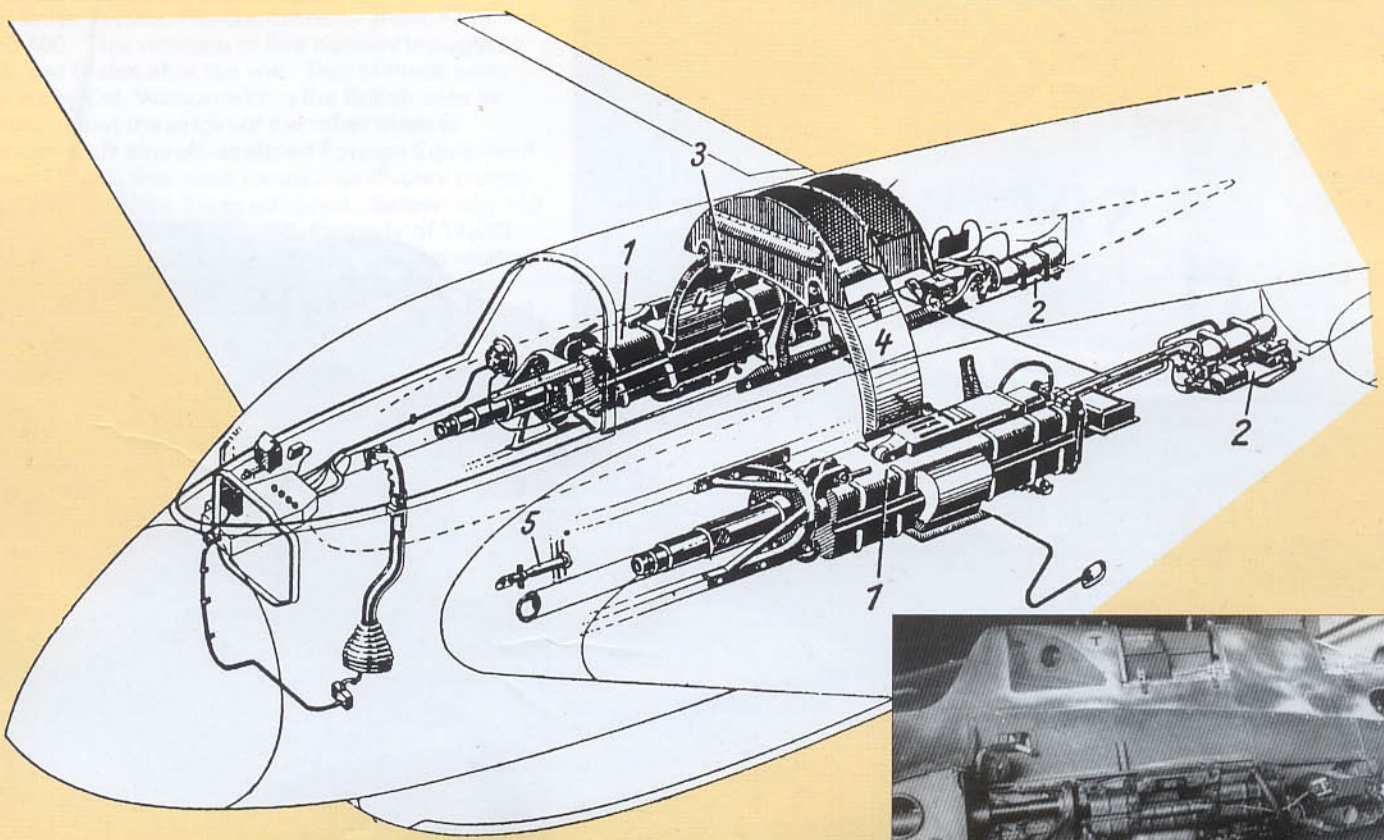
1 Linke Rumpfwand
2 Handrad für Trimmklappenbetätigung
5 Kardangelenk
6 Torsionswelle
7 Druckölbehälter



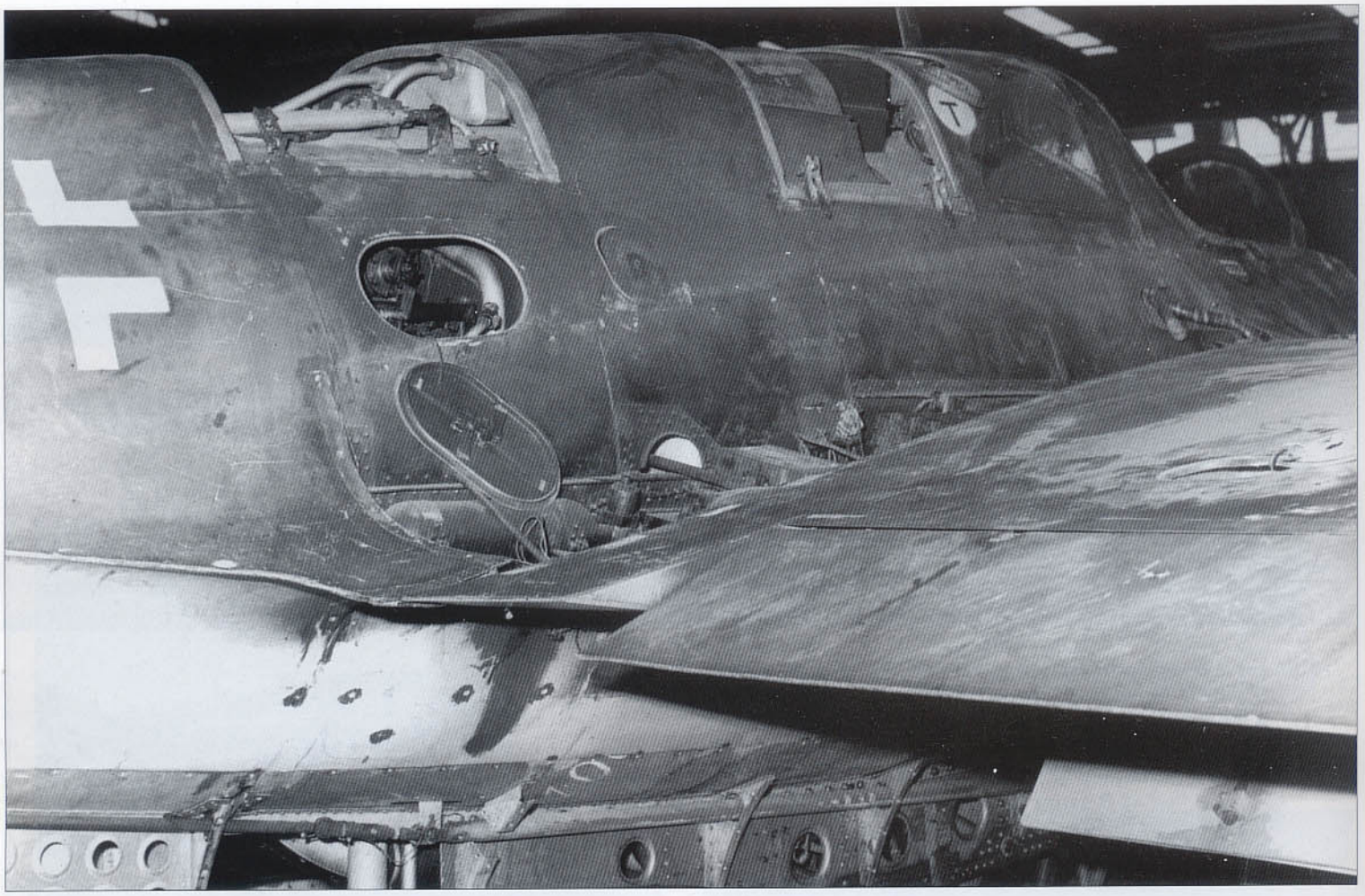
1 Pedale
2 Pußplatte
3 Bodenblech
4 Pedallager
5 Fußhebel
6 Parallelführung
7 Handrad

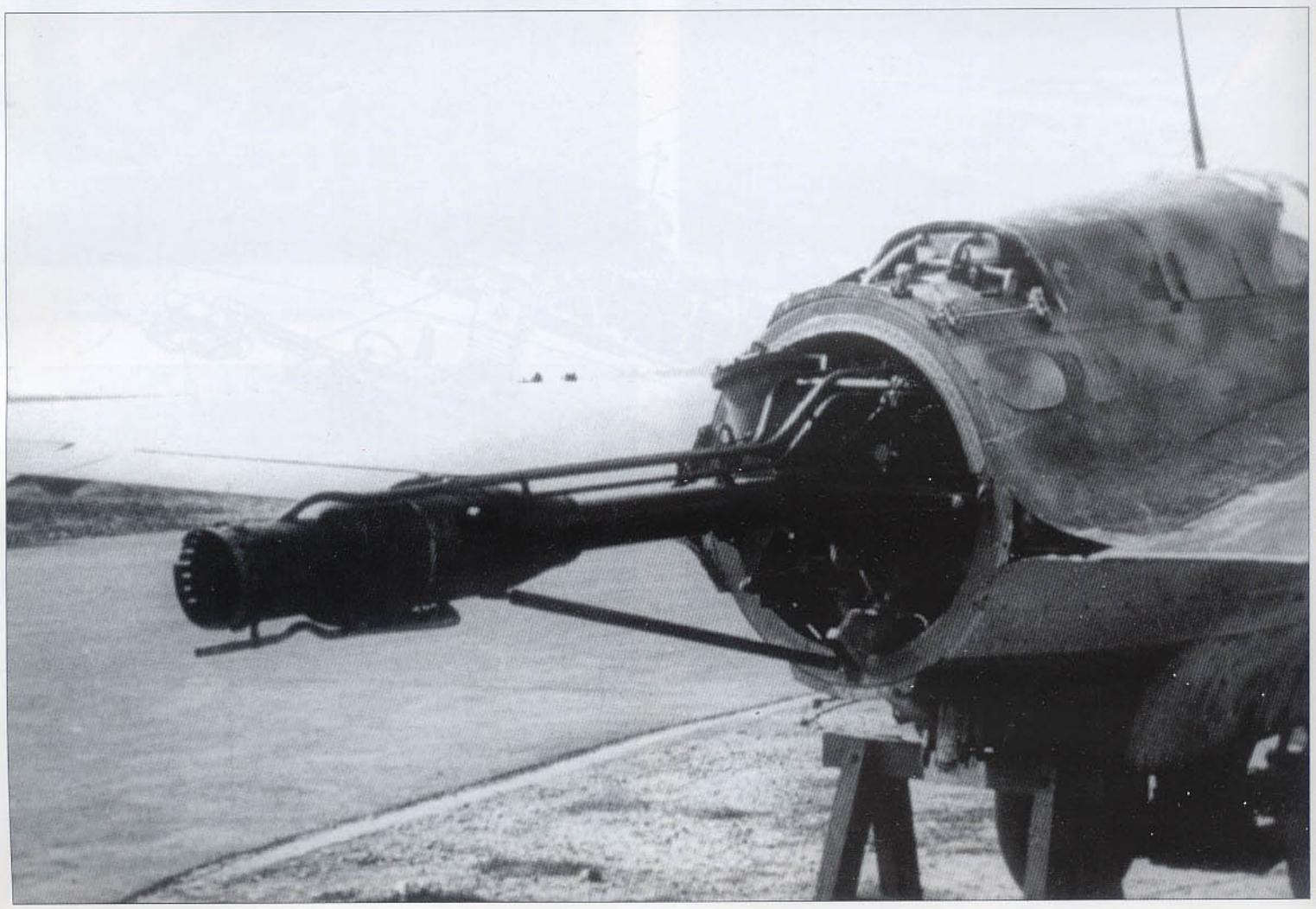


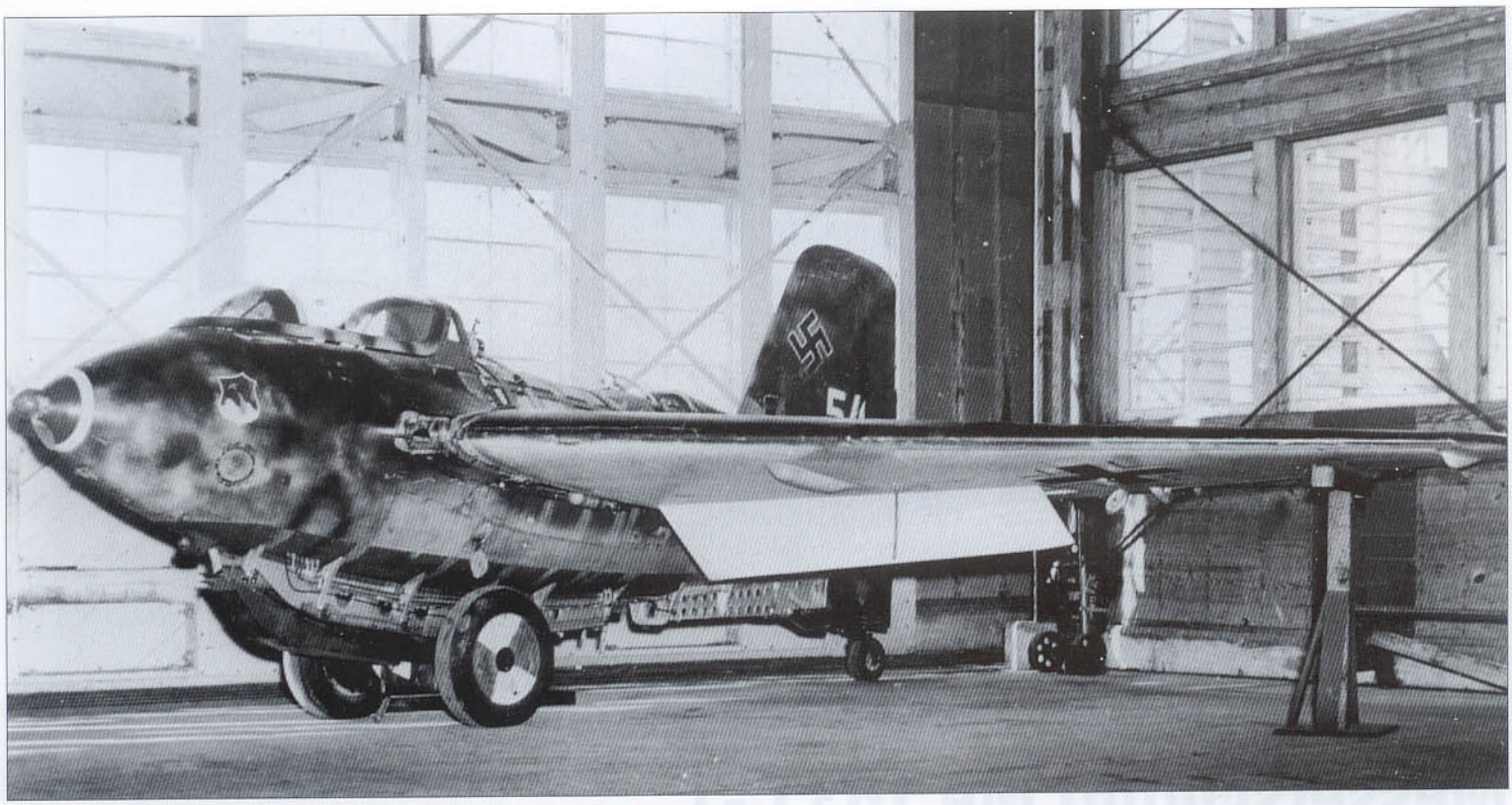
Wing root armament of 2 x MG 151/20 cannon with 120 rpg was restricted to the first 45 B-series aircraft (V1 through V45) known as the Me 163 B-0 preproduction series. The long barrel of this cannon always protruded beyond the wing root opening.



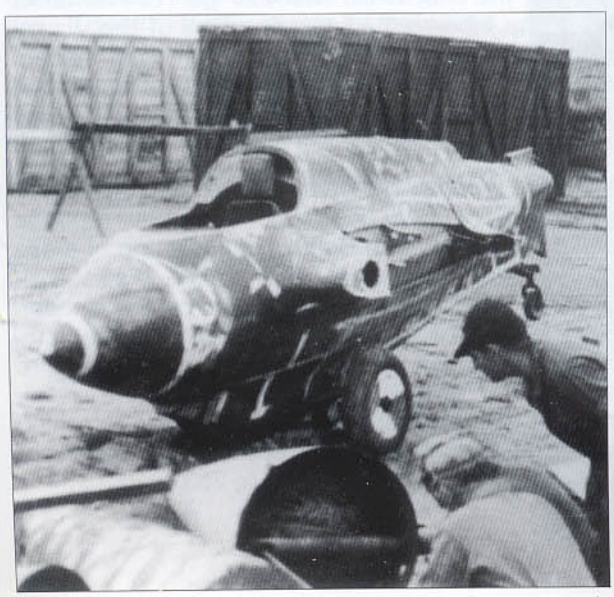
Wing root armament of 2 x MK 108 cannon with 60 rpg was applicable to the last 24 B-0 series aircraft (V46 through V70). It was also standard equipment for the Me 163 B-0/R1, B-0/R2, B-1, B-1/R1 and B-2 series.

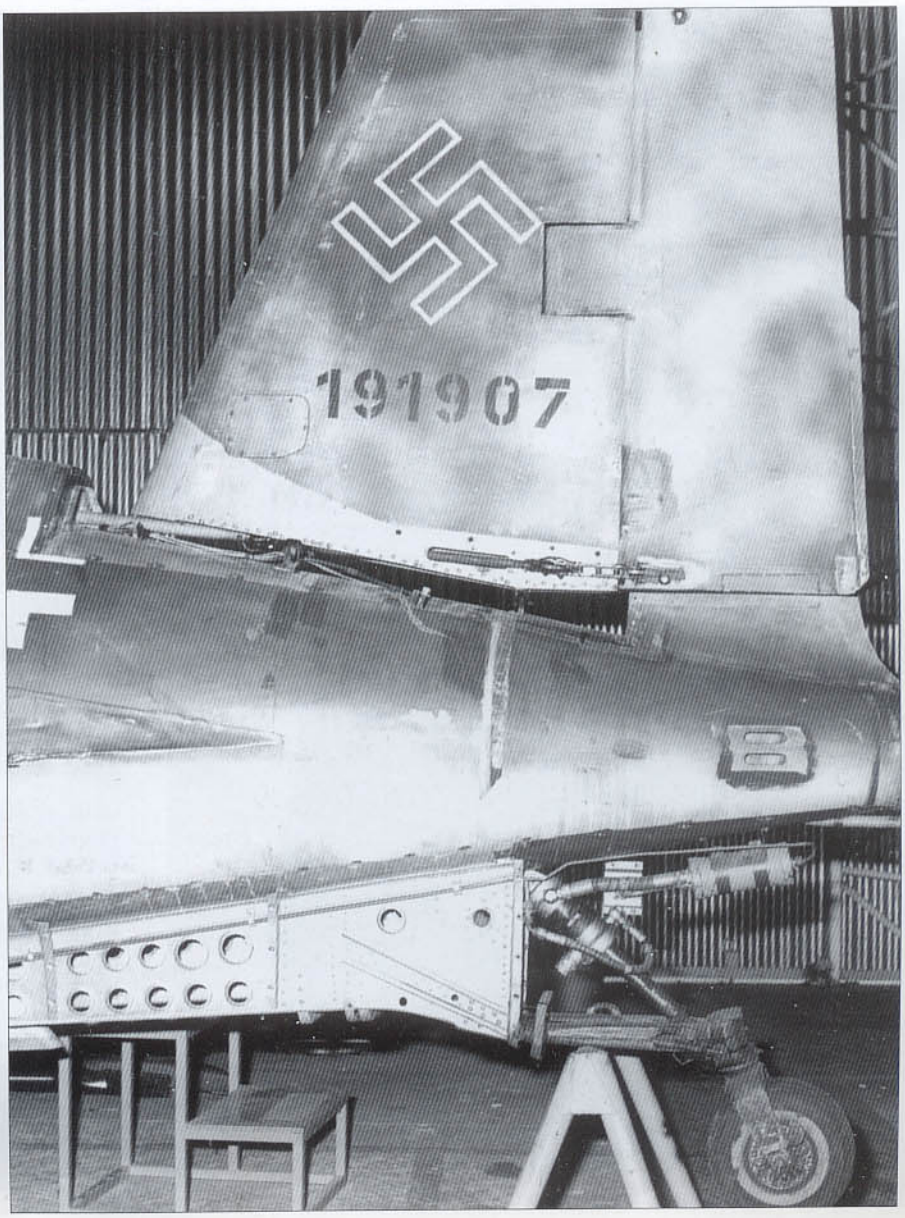


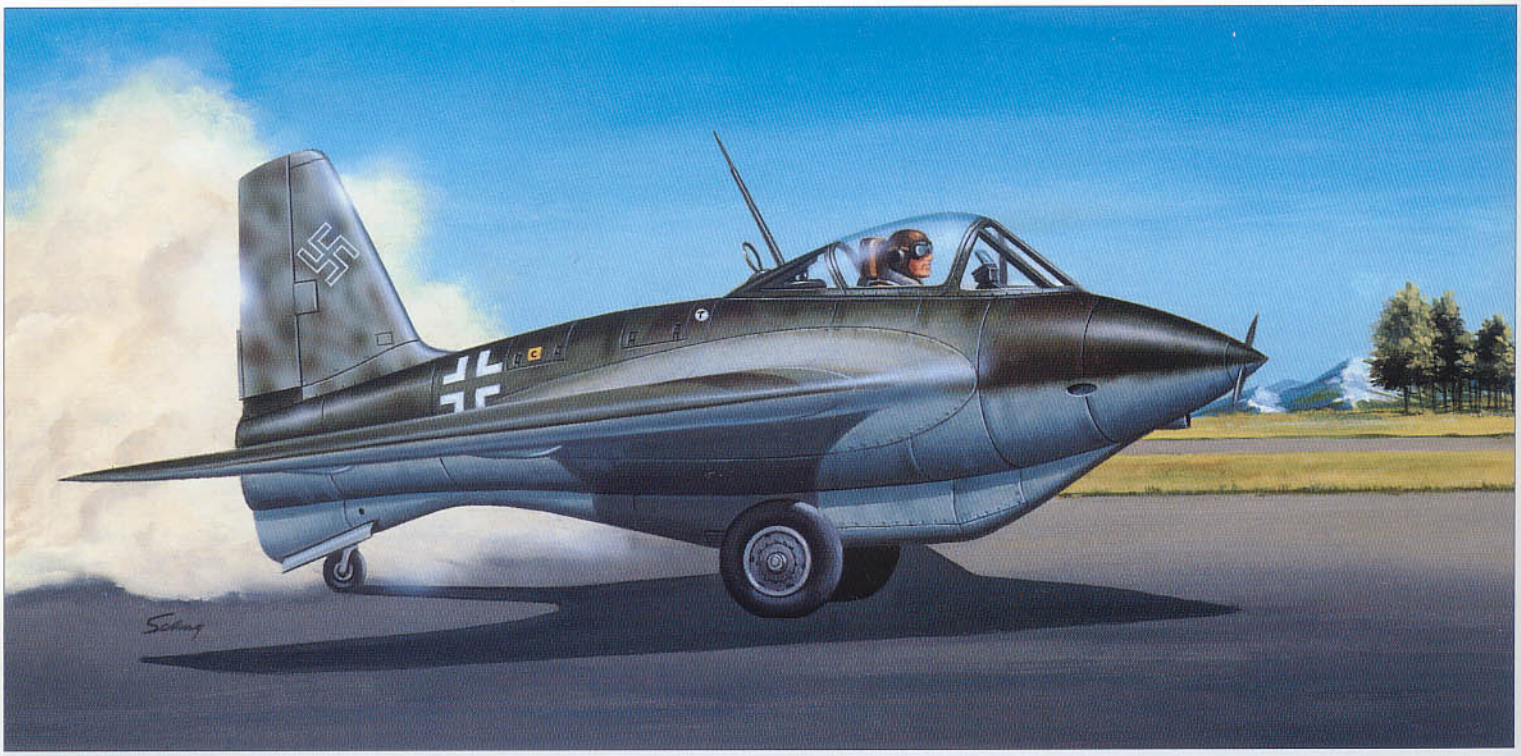




Opposite top: This close-up view shows the fuel tank access hatches as well as the other fuselage details. **Opposite below:** A service view of the exposed Walter HWK 509 A-2 bi-fuel rocket motor which developed a maximum thrust of 3,748 lb (1,700 kg). **Above:** Taken inside one of the buildings at Wright Field, late in 1945, is this photograph of Me 163 B-0 (V54), W.Nr. 310063, PK+QY, formerly attached to 14./JG 400. This was one of five *Komets* brought to the United States after the war. Two of these were acquired by Col. Watson within the British area at Rendsburg, but the origin of the other three is unknown. This aircraft, assigned Foreign Equipment number FE-495, was used for various display purposes up to 1950, when it was scrapped. **Below:** Me 163 B-0 (V56), W.Nr. 310065, KE+SR, formerly of 14./JG 400, shown here at Kassel/Rothweston being readied for shipment to the United States. **Right:** A detail photograph of the Australian *Komet* showing the tail wheel attachment, its stearing mechanism and shock absorber.







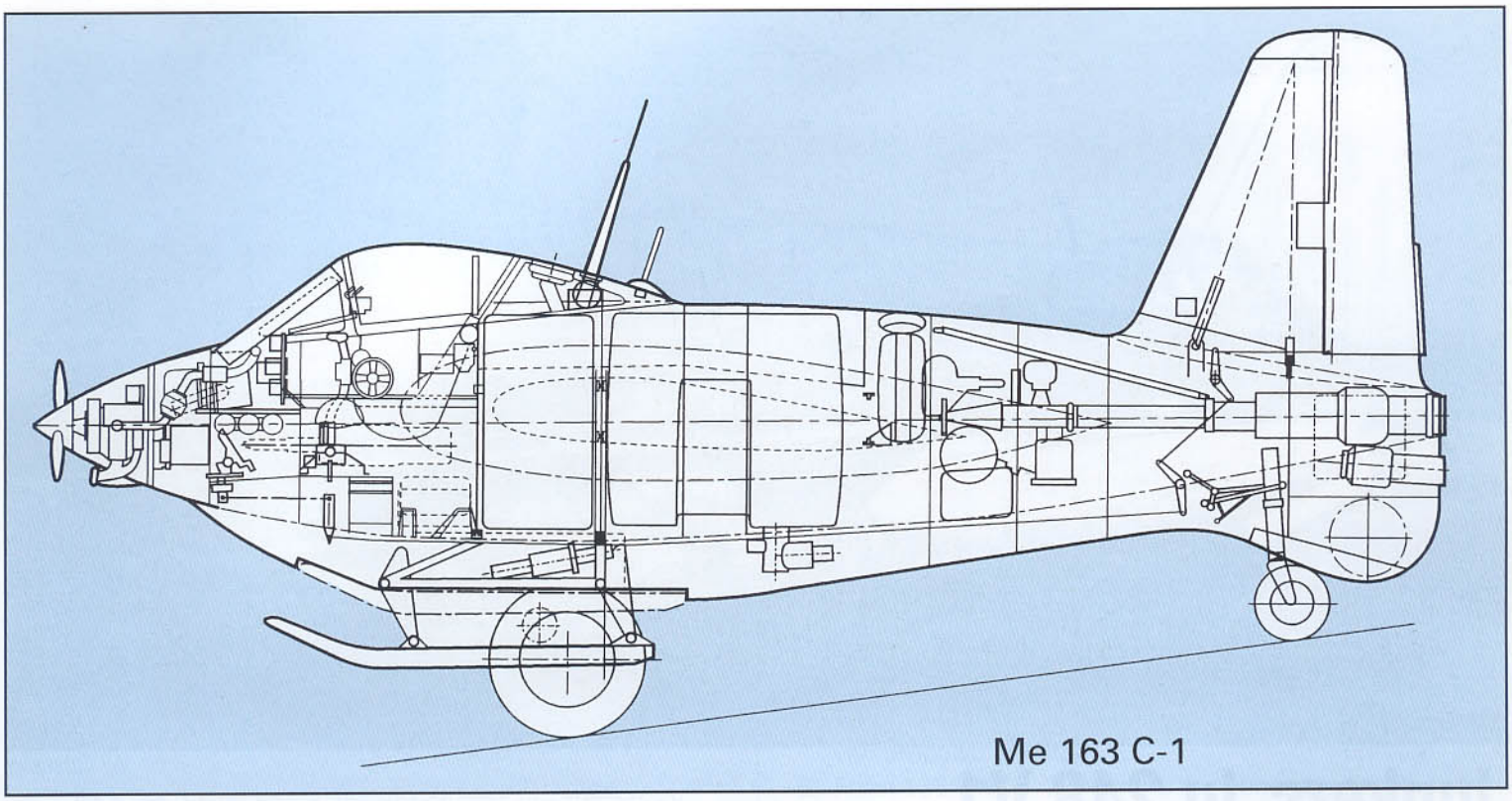
Messerschmitt Me 163 C-1

One of the principal limitations preventing the *Komet* from achieving the success its creators envisioned was its very limited radius of operation. This realization became obvious when Allied bombers altered their bomb routes to avoid contact with the *Komets*. The synthetic fuel manufacturing factories located at Leuna were a favorite target of American heavy bombers. To defend these, I./JG 400, equipped with the *Komet* and based at Brandis, flew numerous missions, but their attempts were frustrated by the *Komet's* limited range. To increase the operational range, *Professor* Walter proposed installation of a smaller auxiliary combustion chamber beneath the standard unit, which could be used as a so-called cruising chamber in conjunction with the main rocket. Two test prototypes were installed with this system, the Me 163 BV6, W.Nr. 310015, VD+EP, and the B V18, W.Nr. 310027, VA+SP. Tests with these two aircraft proved the system worked.

Concurrently, Messerschmitt began preparations for production of the Me 163 C-series, which was designed from the start to incorporate the Walter HWK 509 C-1 bi-fuel, dual-chamber rocket engine. The first drawings of the new C-series were ready in March, 1944. These depicted a new rocket interceptor heavily based on the B-series, but incorporating a heavier armament. These were abandoned in favor of a modified B-series featuring a new all-vision canopy in conjunction with a lowered fuselage spine. Eventually, by August, 1944, a final arrangement was evolved which dispensed with the proposed two wing root-mounted 30 mm MK 103 cannon carrying 40 rpg. Instead, the final armament was to rely on the slow-firing 30 mm MK 108 cannon used in the B-series, but now relocated to a position in the fuselage on either side of the pilot and containing 50 rpg.

Unlike the all-new fuselage of the C-series, the wings were essentially unchanged from the B-series, being made of mixed metal-wood construction. Fuel tankage was to be increased. T-Stoff was to be contained in one large 311.7 gal (1180 ltr) mid- fuselage tank, while C-Stoff was contained in five smaller tanks. One 25.4 gal (96 ltr.) tank was located immediately aft of the pilot while two 40.7 gal (154 ltr) tanks were located in the inboard leading edge area of the wings, with two additional 103 gal (390 ltr) tanks within the inboard wing center sections. This fuel capacity increase of 43 percent over the B-series meant the new Me 163 C could enjoy a full 12 minutes of power-on flight.

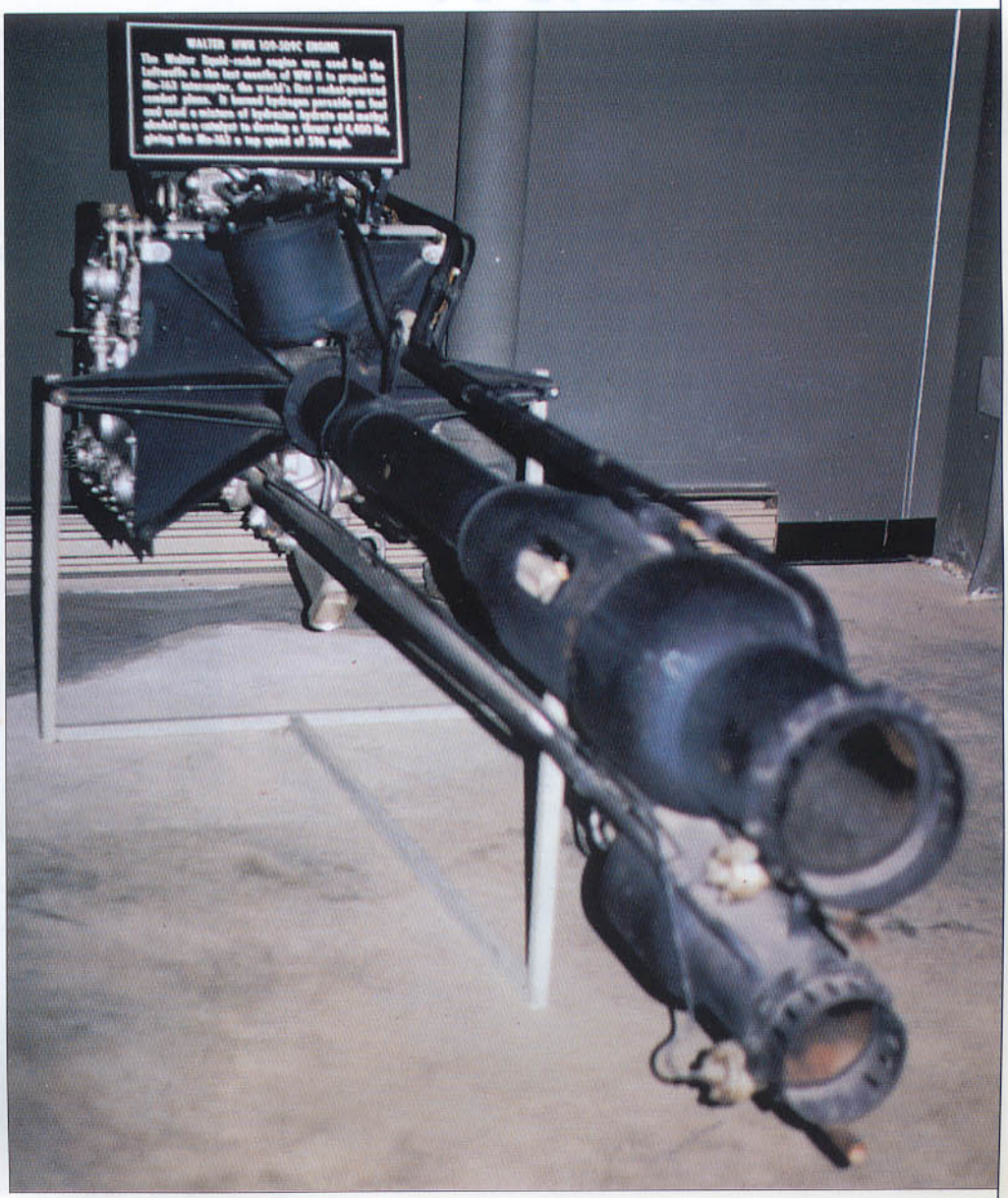
Late in 1944, three C-series prototypes were reportedly completed: the Me 163 C V1, C V2 and C V3. It is further reported that all three were dispatched to Brandis but only one of these aircraft was successfully flown prior to the war's end. Apparently all three prototypes were destroyed by German personnel prior to the field falling to the Soviets. The planned production model, the Me 163 C-1, would have been identical to the three prototypes. However official interest in the C-series, with its inefficient two-wheeled dolly undercarriage, remained only lukewarm especially when officials of the Air Ministry were shown blueprints for the much improved Me 263.

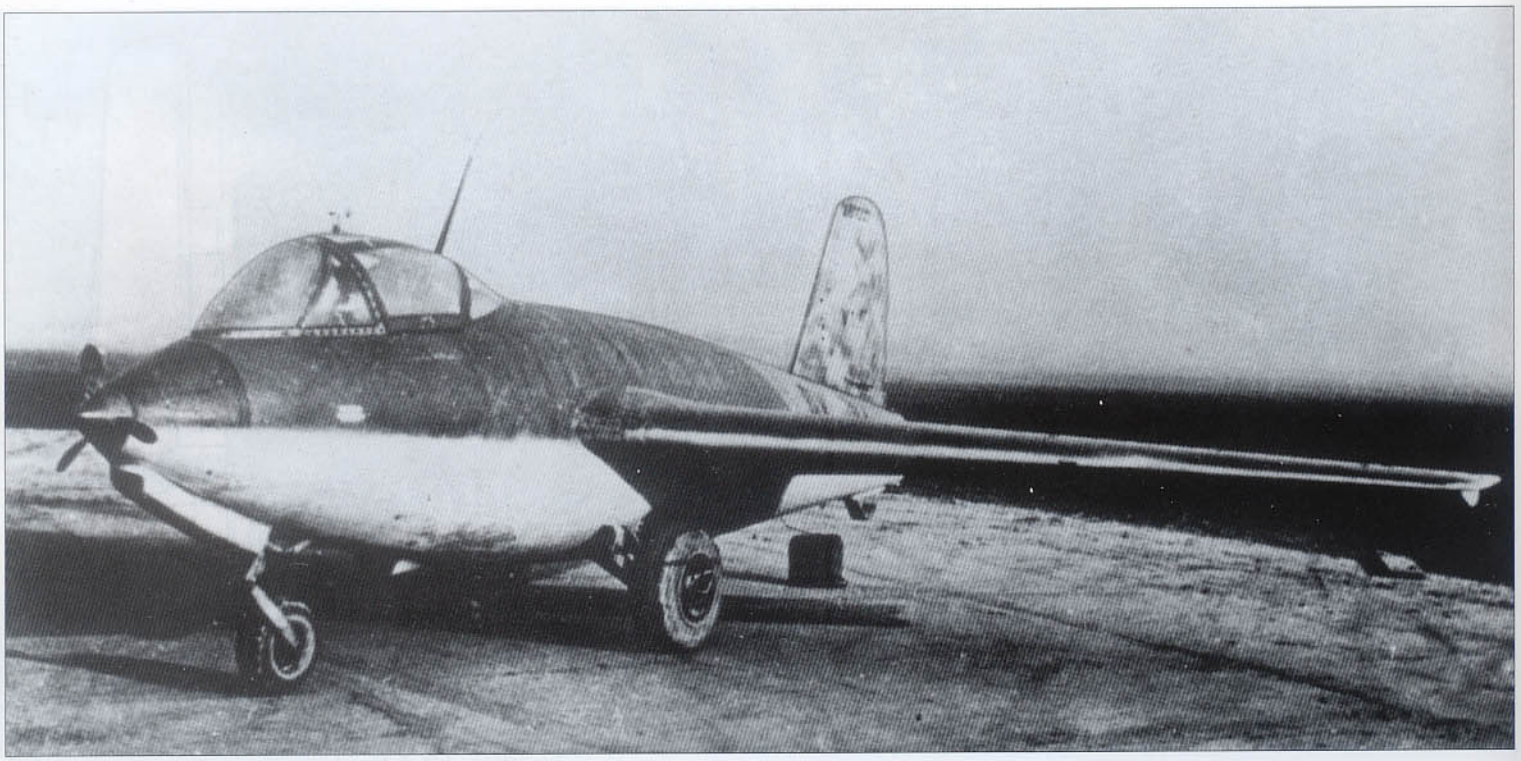


Opposite top: No photograph of a complete Me 163 C-1 is known to have survived the war, but aviation artist Sonny Schug's convincing impression dramatizes the strong relationship the design had with the B-series of *Komets.* The most obvious difference at first glance was the revision of the upper decking and canopy, enabling the pilot to enjoy a much better field of view.

Right: The real difference between the B and C-series was in their rocket motors. Whereas the B-series employed a single combustion chamber, the improved C-series utilized a dual chamber motor known as the Walter HWK 509 C-1. This rocket, shown here on exhibit at the United States Air Force Museum, Wright-Patterson AFB, Ohio, had what is known as a cruise chamber located directly below the main rocket. The purpose of the smaller cruise chamber was to allow the pilot to prolong his mission by careful conservation of fuel. If done correctly, power-on flight time could reach a full twelve minutes.

Opposite left: One of the special instruments carried by the *Komet* was this acceleration instrument (BM4W4 - FI.22802).





Junkers Ju 248 V1

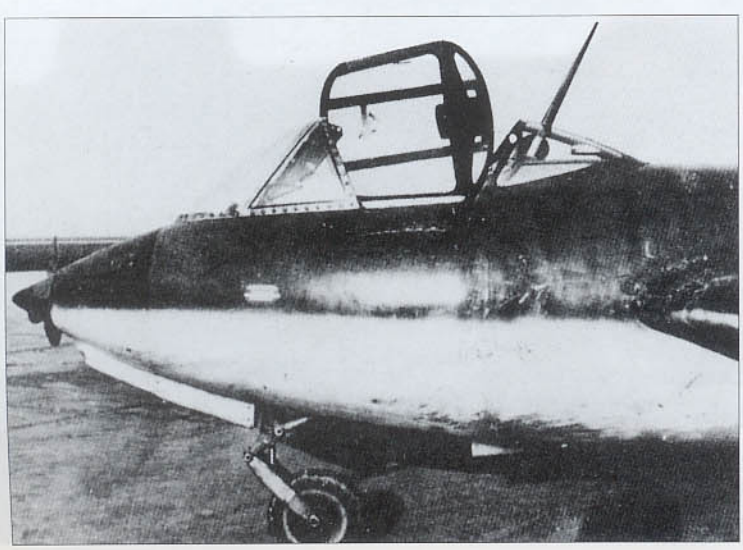
The Ju 248 V1 was a development prototype for a new generation of rocket-powered interceptors. It was designed and built by the Junkers firm in cooperation with Messerschmitt's plan to produce the type in series as the Me 263.

In spite of the fact the Me 163 B was a brilliant achievement, it was recognized as only a first step. Service testing confirmed what was already known. The Me 163 B lacked endurance, range and a proper landing gear. To address the endurance question, the Walter company produced the HWK 509 C bi-fuel rocket engine with a smaller auxiliary cruising chamber position directly beneath the primary power chamber. With proper application of controls, and in conjunction with greater fuel capacity, the new aircraft extended both its endurance and range. Fitting the new interceptor with a conventional landing gear, in place of the dolly and skid, would greatly facilitate recovery and refitting.

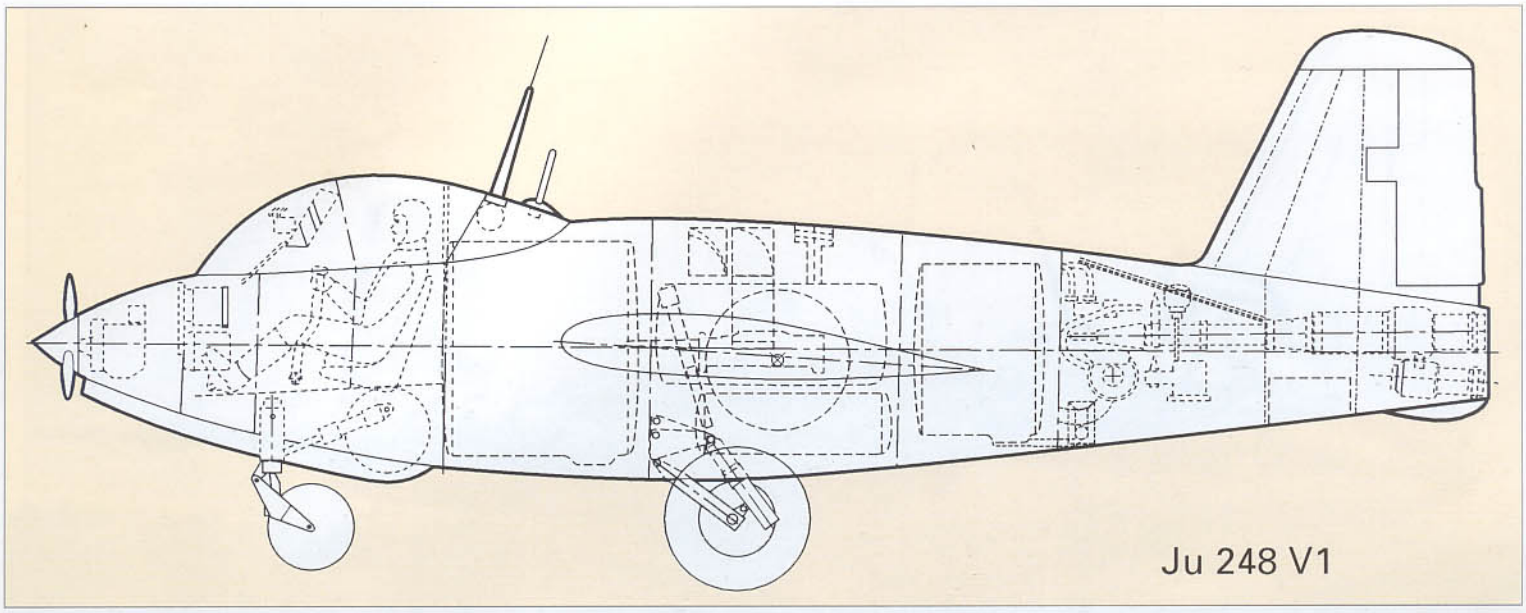
As recounted earlier (p. 250), the Me 163 BV6 and BV18 had each been modified to flight test the new HWK 509 C-1 bi-fuel motor. The improved Me 163 C would have addressed the question of limited endurance and range, but left unresolved the important question of quick aircraft retrieval. Therefore, the Air Ministry recognized the importance of proceeding quickly with a new interceptor designed specifically to solve the problems of endurance, range and swift aircraft retrieval. However, as the Air Ministry appreciated the fact that Messerschmitt was already fully occupied with other projects, the task of turning the new interceptor into reality fell to the Junkers firm, under the leadership of *Prof.* Heinrich Hertel.

During the summer of 1944, *Prof.* Hertel and his engineers, building upon Messerschmitt's preliminary work, evolved a new interceptor broadly based on the Me 163 B and C, but incorporating a number of new features. By autumn 1944, construction of the new prototype had begun at Junker's Dessau facility. It featured cabin pressurization, a new all-vision canopy, a retractable tricycle undercarriage, a braking parachute, a HWK 509 C rocket, and a longer circular fuselage with an Me 163 B tailplane mated to a new swept wing which housed two MK 108 cannons in the root area. To flight test the feasibility of fitting the interceptor with a retractable tricycle landing gear, the Me 163 BV18 was modified with one of several designs advanced by Messerschmitt and flight tested at the end of December,1944, by Heinz Peters. The results of these tests were encouraging.

The first prototype, the Ju 248 V1, W.Nr. 381001, DV+PA, was completed at the end of January, 1945, and flown for the first time, with air tow on February 8, 1945, by Junkers



Above and left: Built by the Junkers company in cooperation with Messerschmitt as a development aircraft, the Ju 248 V1, W.Nr. 381001, DV+PA, was the first of three prototypes assembled as progenitors of the Me 263. The most notable features were the retractable landing gear, the improved cockpit canopy and the dual chamber rocket motor. By the middle of February, 1945, this aircraft had logged over three hours in the air.



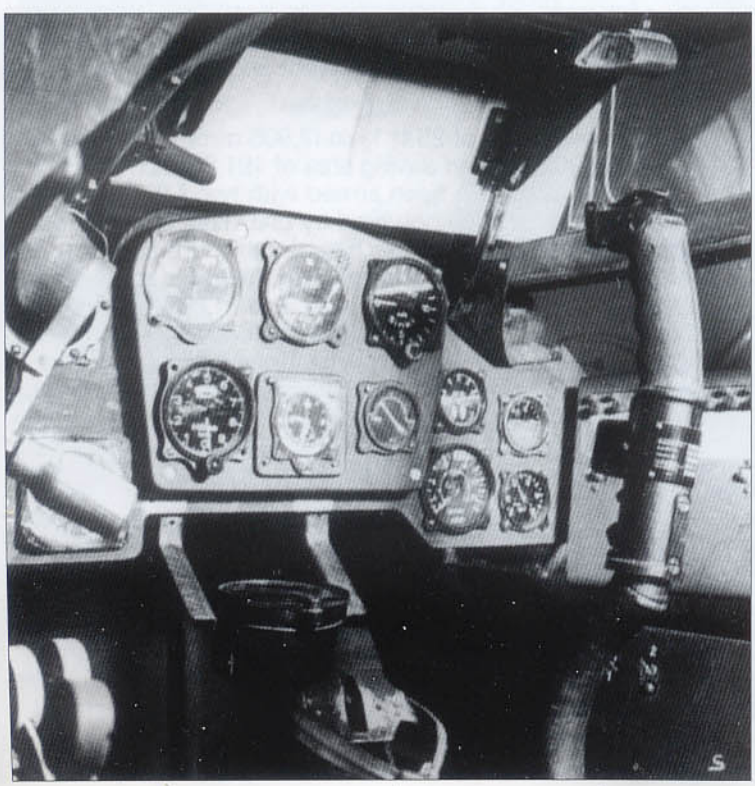
test pilot Heinz Pancherz. By February 19, 1945, a total of 13 flights logging a total air time of 3 hrs 27 minutes had been achieved.

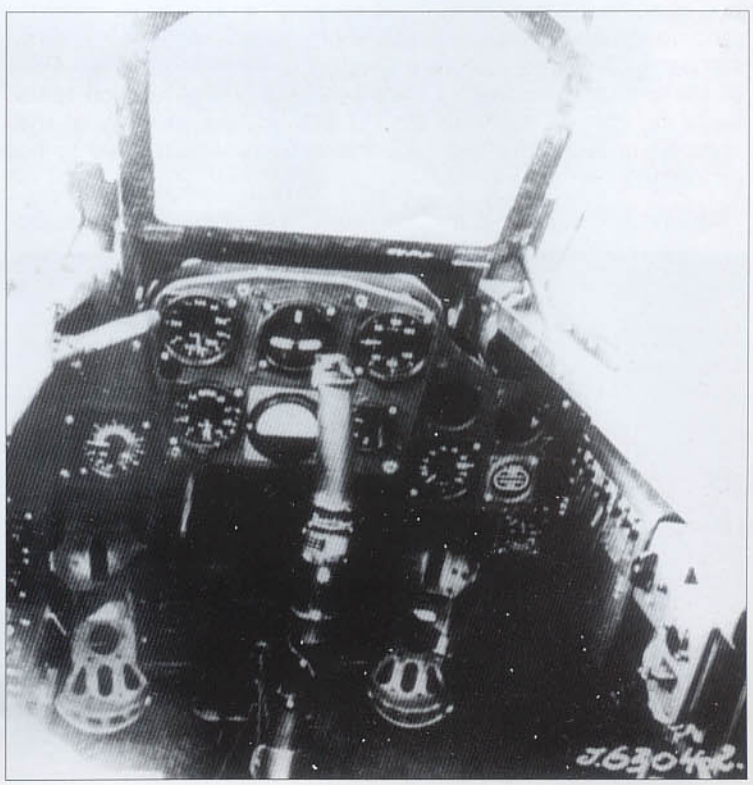
In this report, Heinz Pancherz noted the following eight complaints:

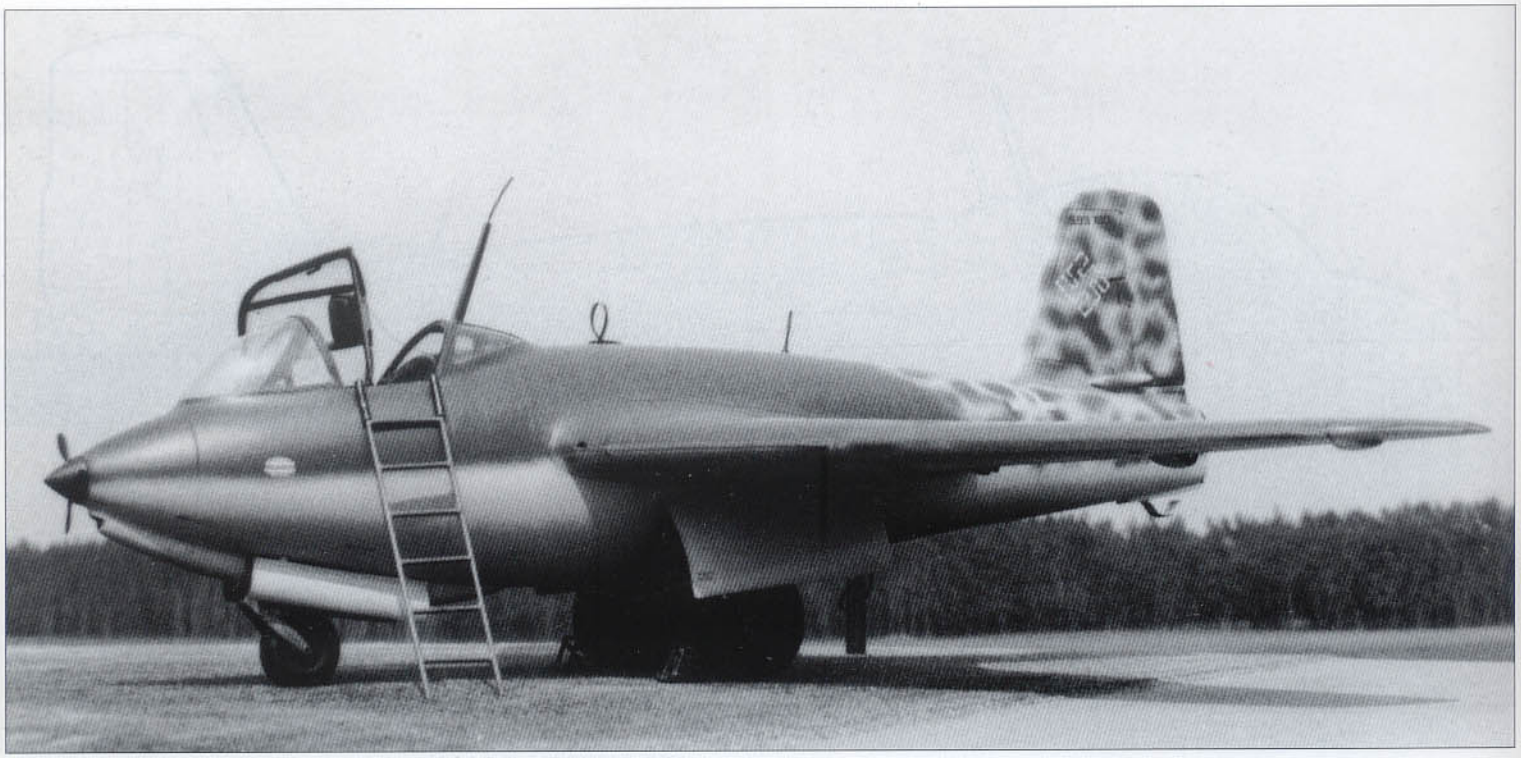
1. The nose-wheel shock absorption was unsatisfactory during the last flights.
2. The compressor and generator gear noise level was irritating. Could be a broken gear or bearing?
3. The trim-wheel handle should not fold back, since it would fold during rapid turning, making proper trimming difficult.
4. The entire aircraft vibrated violently immediately after being airborne, making it impossible to read instruments. Reason not clear, but vibrations occurred simultaneously with starting of the Seppeler propeller (small wind-driven propeller in nose).
5. From 136.7 mph (220 km/h), the generator developed no power; however it should be sufficient for powered flight.
6. The landing flaps extended too fast.
7. The handles for the braking chute release and emergency fuel dumping could be confused. Chute release forces too heavy. It should move easily, since the pilot may otherwise make involuntary control movements.
8. Brakes should be more efficient. The same brakes were better in the Me 163 BV18. Heinz Pancherz concluded his report by noting, "Good brakes are life-essential in case of an aborted sharp take-off."

Below: A Junkers mock-up of the proposed cockpit for the Ju 248 showing an instrument panel based closely on the Me 163 B.

Below right: A view of the finished cockpit of the Ju 248 V1 showing only slight deviation from the mock-up. Note that two instruments for the upper right section of the panel have not been installed. These may have been for two thrust indicators.



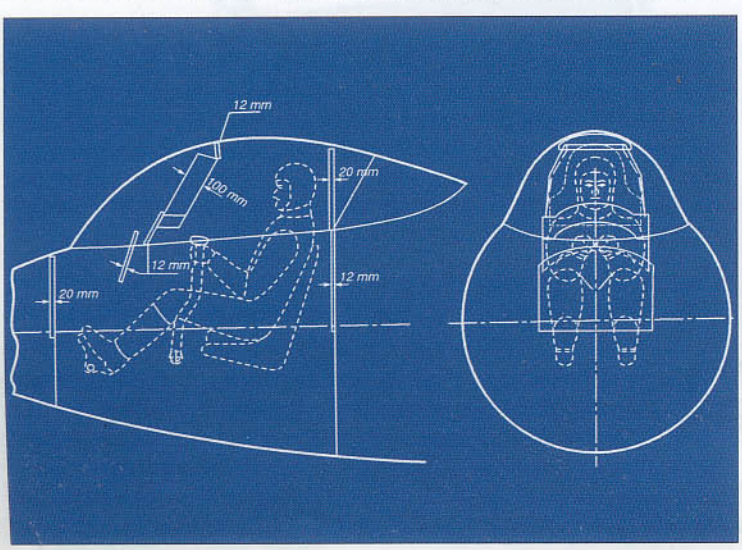




Messerschmitt Me 263 A-1

The Ju 248 V1 was the first of twenty planned prototypes to be built by Junkers in conjunction with the production of no less than 952 aircraft of the Me 263 A-1 series. The RLM GL/C number 8-248 had been used exclusively for Junkers-built prototypes, whereas the GL/C number 8-263, assigned to Messerschmitt, was reserved for production aircraft.
Production models of the Me 263 were to be closely patterned after the first prototype, with only minor modifications in keeping with flight tests of the first prototype. Junkers flight test pilot Heinz Pancherz commented favorably on the braking parachute, except that the release forces were too high. He also gave high marks for cockpit visibility, seating comfort, arrangement of controls and levers. Pancherz and others were, however, quite critical of the instrument panel arrangement. They had repeatedly demanded all engine control instruments (engine speed, two combustion- chamber pressure meters, temperature control - if fitted) should be moved to the left side of the instrument panel. Canopy release and/or jettison tests were not carried out with the Ju 248 V1, but in view of the complaints about the Me 163, these tests would have to be conducted.

Flugkapitän Pancherz found the retractable undercarriage to be satisfactory during all landings including a very heavy one, when the aircraft was pancaked from about 16.4 feet (5 m). He noted: "With the older Me 163 B, with only a skid the pilot would have been hospitalized after a landing of this sort." This heavy landing occurred during the first flight when the much-too-heavy forces needed to release the brake parachute which resulted in an inadvertent pull on the stick, leading to a very high flare-out.



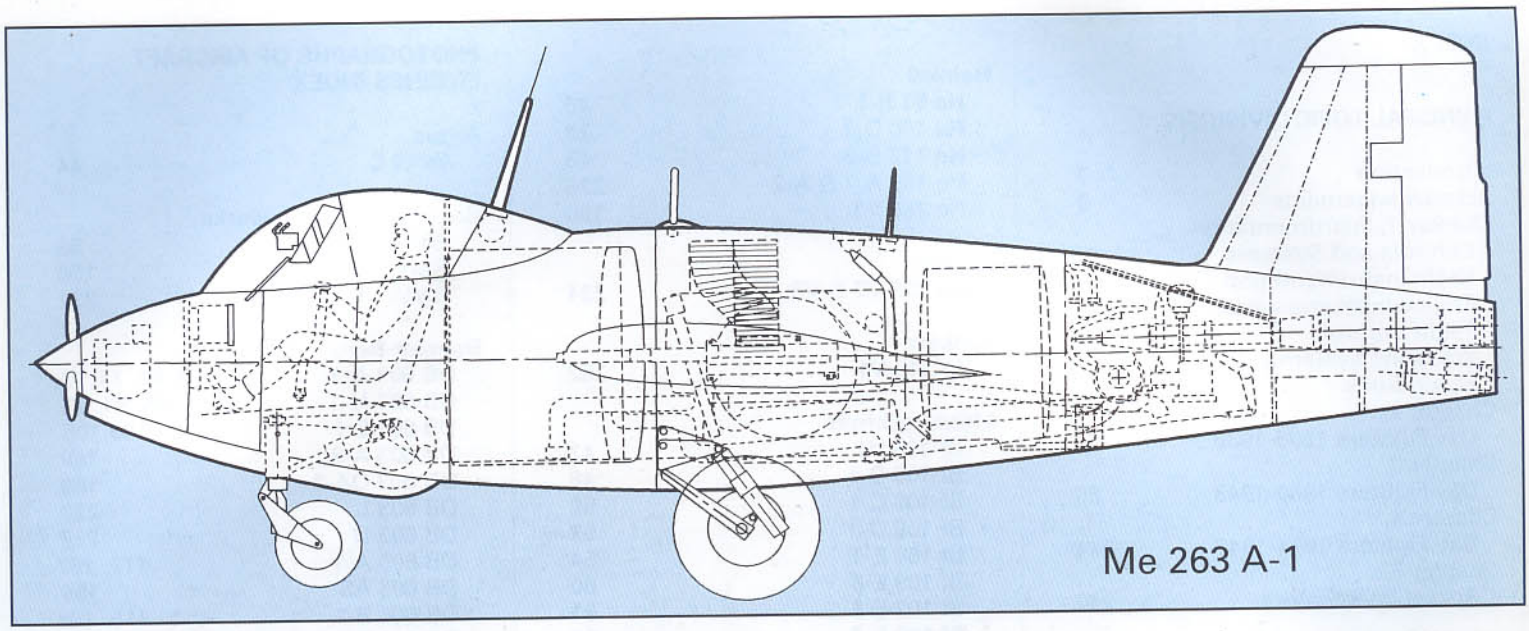
In his opinion, *Flugkapitän* Pancherz believed the Ju 248 V1 made an absolutely finished impression. He did, however, favor moving the center of gravity to the rear by 17 inches (440 mm), which could be accomplished by repositioning the landing gear further aft.

Even before additional prototypes had been built, or powered flights with the first prototype had been undertaken, plans to push the Me 263 into production went ahead with the highest priority.

With an overall length of 25 ft 11 in (7,905 mm), a wing span of 31 ft 2 in (9,500 mm) and a wing area of 191.60 ft (17.8 m), the Me 263 A-1 would have been armed with two MK 108 cannon with 75 rpg. It was to be powered by one HWK 509 C-4 rocket engine and was capable of reaching a maximum speed of 590 mph (944 km/h). It could have reached 49,000 feet (14,950 m) in 3 minutes. A fuel capacity of 426.9 gal (1,616 ltr) of C-Stoff carried within the fuselage, plus 179 gal (680 ltr) of T-Stoff contained within the wings, would have allowed for a burn-time of approximately 15 minutes. Interestingly, the 4,410 lb (2,000 kg) thrust Walter rocket engine was eventually to be replaced by the 5,510 lb (2,499 kg) thrust BMW 708 rocket, which used nitric acid.

Above: A large-scale model of the Me 263 A-1, created by master model maker Günter Sengfelder, captures in great detail the salient features of the design.

Left: A drawing showing the placement of pilot armor. The upper half of the nose cone and pilot's shoulder and head protection would have received armor of 20 mm thickness, while the pilot's back and the instrument panel would each have received armor of 12 mm. The bullet resistant interior forward glass would have been almost 4 inches (100 mm) thick.



The Me 263 A-1 was to be issued to JG 400 based at Brandis, a *Luftwaffe* unit with considerable experience in operating the Me 163 B; however, none were delivered before the end of the war in May, 1945. Up to March, 1945, in addition to the Ju 248 V1, two more aircraft, the Ju 248 V2 and V3, had been completed by Junkers at Dessau. It is unknown if any production machines were actually assembled prior to the arrival of Soviet troops. Nevertheless, it is interesting to note that an official US Army report dated June 16, 1945, indicated no fewer than 13 examples of the "Me 163 C" had been located in the British area at Husum, Denmark, in partially dismantled condition. A total of seven of these were to be earmarked for Category 1 priorities. Inasmuch as the Me 163 C was officially abandoned, apart from a few prototypes, it is clear that these aircraft were mislabeled by the Allies. Their true identities may never be known, but it is probable that some or all of these 13 aircraft were incomplete examples of the Me 263 A-1. Our photograph **below,** taken at Allied field R-12, Kassel/ Rothwesten, clearly shows the hulk of an incomplete Me 263 A-1, together with other disassembled aircraft. Other known photographs taken by British forces in their sector, showing incomplete fuselage sections of the Me 263 A-1, lends credence to the American Army report, but leaves unanswered the question of how these aircraft found their way from Dessau to Denmark. Apparently, the US Army was not interested in these incomplete airframes, as there is no record of any being subsequently shipped to the United States.

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