SECRET WONDER WEAPONS OF THE THIRD REICH

German Missiles 1934-1945

J. Miranda
& P. Mercado

INDEX

The authors wish to express their gratitude to David Masters and his family for the great help received from them throughout the different stages of this work.

This book deals with both real machines which were built and flown, and fantastic projects which did not go beyond the drawing table. To avoid any confusion to the reader, drawings showing projects are marked with an asterisk.

Most of the drawings are scaled to 1/72 for the benefit of modellers. Otherwise the scale is indicated beside the drawing.

The authors have decided to present some of these projects in color, with emblems and camouflage patterns similar to the ones used by the Luftwaffe; the only intention being to stimulate the reader's imagination and make the work more attractive.

J. Miranda and P. Mercado

"REICHSDREAMS"

When the balance of military power began to slope in favor of the Allies during the last months of 1942, the Axis powers had to change their "conquer and consolidation" strategy for another of "defense of the metropolitan territory". The industrial reorganization derived from this sudden change of political objectives proved to be of such magnitude that Germany could only comply with it partially. It was carried out by burying whole factories under armored tunnels, scattering industries to make enemy bombardments more difficult, developing new chemical technologies to compensate for the loss of raw materials, such as rubber and oil, and exploring Physics in all directions in the hope of finding alternative industrial procedures, detection systems, new materials for engineering, or the final weapon.

Geographical imperatives forced the Allies to depend on aviation to "carry the war" to the German metropolitan territory. Bombing raids made little damage to the Reich industry, but had a devastating effect among the population. This was the reason why top priority was given to anti-aircraft defense: artillery, missiles, radar, and high performance fighters.

In this way, German scientists and engineers, working under high Pressurizer and having the right resources and motivation, created a huge dossier of projects without equal in the history of aeronautical technology, as much as for the variety and ingenuity of designs as for the limited human resources and short span of time (five years) available to produce these amazing scientific and technological achievements.

Contemporary engineer's fantasy is strongly determined by such conservative terms as profit, safety, etc., all very reasonable in peaceful times. Exotic ideas which are not turned down in the computer are eliminated in the wind tunnel. Their German colleagues of 1943, however, had nothing to lose, they tested everything and succeeded many times, as the winning powers confirmed in post-war years.

THE FIRST MISSILES

"The biggest target in the world", where any German pilot could easily strike with his bombs, was in 1940 the great city of London. But, which one was the tiniest and most difficult? No doubt, it was a small English destroyer desperately maneuvering to avoid the attack of the Stukas.

Naval objectives were so difficult to hit that on 12-7-40, during a series of aerial attacks by the Italians against the big and sluggish British battleship HMS Warspite, not even one of the 300 bombs dropped between 8:50 and 11:50 hit their target.

Only the courage shown by German and Japanese pilots when diving during their attacks gave some tactical results. However, the price paid to the Flak and to the fighters of the Allied fleet was usually too high in lives and airplanes.

The Japanese believed to have found the answer with the sacrifice of their pilots in their special attack units "Kamikaze" and "Tokubetsu". The Germans created guided missiles which could be launched from planes at a great distance, thus planes were not exposed to the efficient anti-aircraft machinery of the enemy. At first, they consisted of already existing weapons that had been tested in combat.

Adding wings and fins to normal bombs and torpedoes made them capable of gliding until their impact against ships. They were guided to the target by a cable, a radio beam, or by means of rudimentary passive sensors of radar, infrared rays, or a magnetic or acoustic field installed on board.

From May 1944, they also used converted "Mistel" bombers, which were thrown against targets in a collision path under auto pilot control.

On the contrary, there were two unpiloted German airplanes so designed from the beginning: the Arado E 377 and the Fieseler Fi 103. The first, assigned to replace early "Misteln" models, followed the concept of being launched inside the visual range of the target and guided by a gyroscopic plant.

The second was the first operational cruise missile in history, able to fly correcting variations of path and altitude to the target thanks to a gyroscopic plant and a magnetic compass.

The weapon came into service in June 1944 under the propagandistic name of "Vergeltungswaffe Ein" (V-1), so beginning a new type of war which would change strategic concepts for decades.

RUHRSTALH/KRAMER X-1 "Fritz-X"

Officially designated PC 1400X, it was an improvement on the armor piercing bomb PC 1400 "Fritz" used by the Luftwaffe against great battleships.

It had a piercing head and thick steel revetment to absorb the impact against the ship, and housed 300 kgs. of "Amatol" explosive.

A radio receiver and an electromechanical device were installed inside its fuselage, behind the explosive head, to transmit driving impulses to the fins in front, thus controlling the descent trajectory.

The "Fritz" was launched as a normal bomb from a plane flying at high altitude. To make it more visible during the dive, flares were ignited on its tail. Then, a very well trained operator, positioned in the launch airplane's nose, rectified the bomb's trajectory by means of very gentle radio impulses until target and missile trajectory coincided.

Operational development

The "Fritz-X" operated in the Mediterranean on 8-9-43, together with the Do-217 K-2 and K-3 of the II/KG-100, sinking the Italian battleship "Roma" and damaging the "Italia".

As for the Allied ships, they sank the destroyer "Janus" and damaged the battleship "Warspite", as well as the cruisers "Savannah" and "Uganda".

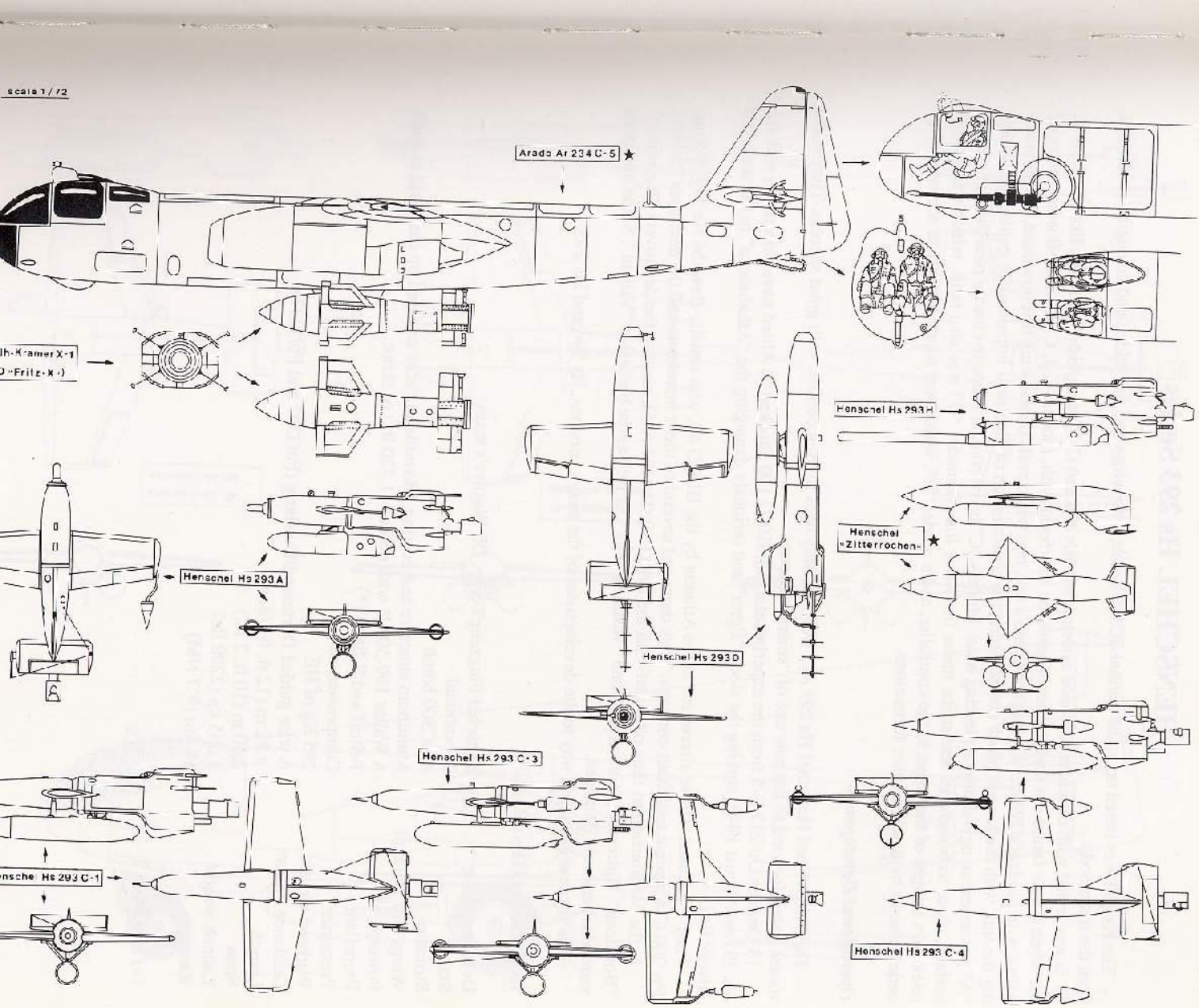
Having in mind the most conservative statistics of the time, 5000 conventional bombs would have been necessary to achieve the same result!

The "Fritz-X" was also used over land against the bridges over the river Oder in April 1945.

Technical Data

Designer office	Dr. Kramer's DVL (Deutsche Versuchsanstalt für Luft.fahrt)
Stage	Operational
Structure	special anti-armor steel of a great thickness
Tail unit	cruciform section strengthened by a twelve-sided perimeter. It had a two-axis guideable fin, actuated by Wagner electrical controls.
Powerplant	None in first versions. Several accelerator rockets of solid propellant were foreseen.
Equipment	Radio-link system Kehl/Strassburg (FuG203 and FuG230)
Warhead	320 Kg of Amatol
Length	3.26 m (10 ft. 8 1/2 in.)
Span	(elevator) 1.35 m (4 ft. 5 in.)
Maximum diameter	0.56 m (1 ft. 10 in.)
Launch weight	(unpropelled version) 1,570 kg (3,454 lb.)
Maximum speed	1,035 km/h (630 MPH)
Range	5 km (2'69 NM)
Number of units built	1,386

(*) See Table 4


scale 1 / 72
Arado Ar 234 C-5 ★
lh-Kramer X-1
"Fritz-X")
Henschel Hs 293 H
Henschel Hs 293 A
Henschel Hs 293 D
Henschel
"Zitterrochen" ★
Henschel Hs 293 C-3
nschel Hs 293 C-1
Henschel Hs 293 C-4

HENSCHEL Hs 293 Series

The Hs 293 was based upon the normal SC500 bomb, with wings and fins added and an engine suspended from the main body.

It was tested with different guidance systems. Models V-4 and C-1 were guided by radio, like the Fritz-X, but when it was found out that the beam could be interfered with, models C-3, C-4, and A-0 were equipped with a wire guidance system. During the bomb's fall, two wired coils on the wing tips unwound, so maintaining the link with the launch plane and allowing the transmission of electrical impulses for guidance. Models "A" possessed an ogival armor piercing head. Models "C" had a conical shape to cleanly pass through the sea surface, close to broadside, and strike under the water line. A model "D" was also built, which transmitted television images of the target to the controller, and a model "H", which was supplied with an acoustic/magnetic detector to attack bomber formations.

Operational Development

The Fritz-X and Henschel Hs 293 A-1 were the only ones used in combat with great success. They really meant a step forward to the new age of "smart" weapons.

18 Dornier Do 217 E-5 from the experimental unit II/KG 100 attacked an Allied naval formation with the Hs 293 on August 1943, sinking the sloop "Egret" and seriously damaging the "Athabascan" in the waters of Biscay Bay.

They were used a little afterwards in the Atlantic by the III/KG 40, who usually flew the He 177 A-5 and Fw 200 C-4 against merchant convoys. They damaged several of these merchants and the destroyer "Jervis".

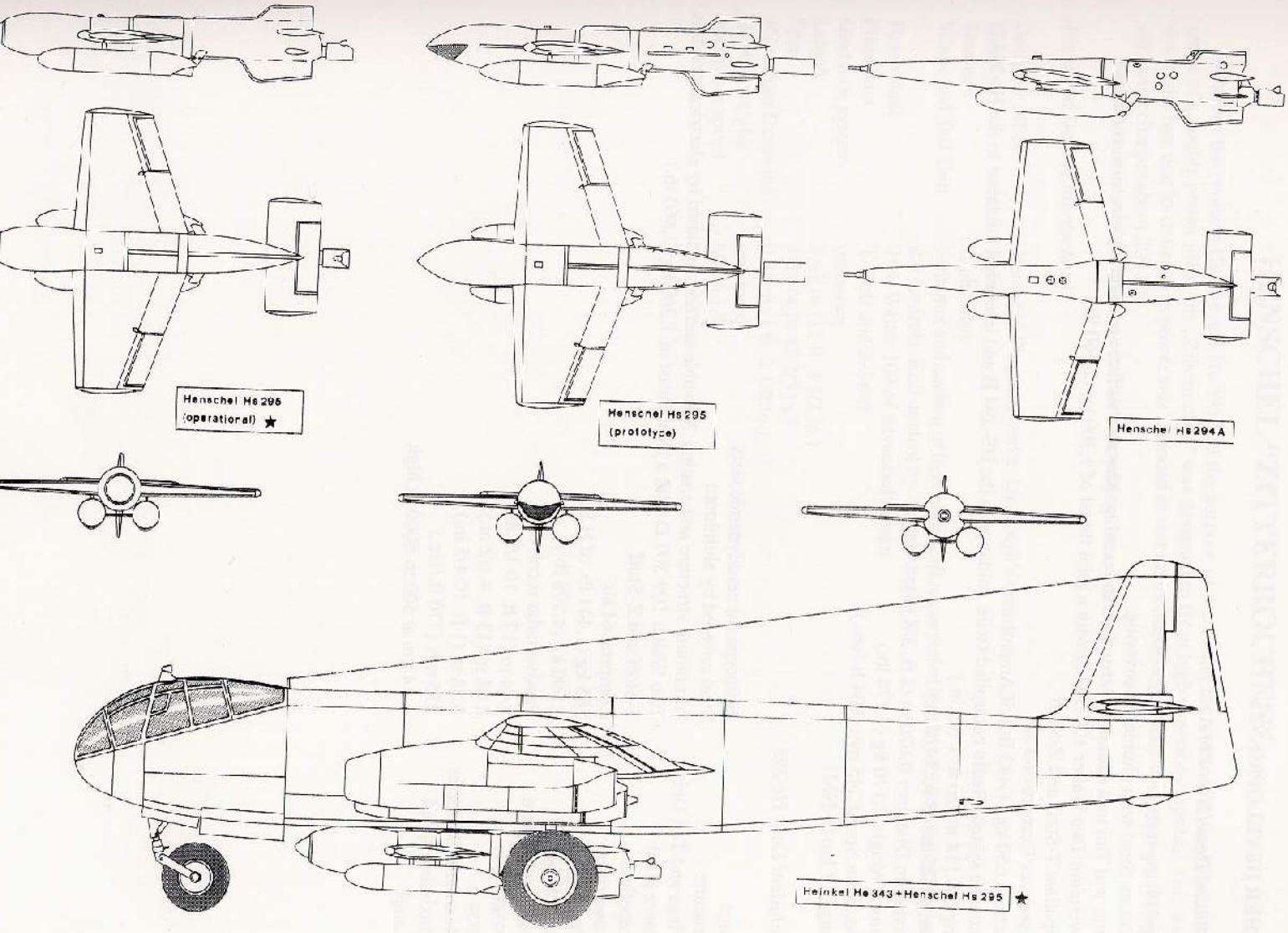
In the Mediterranean they operated with the II/KG 40 (He 177 A-5), sinking the destroyers "Inglefield", "Boadicea", "Intrepid", "Culverton", and "Vasilissa Olga", as well as the battleship "Valiant". Some transports were also seriously damaged.

This success eased the way to the development of the heavy versions, Hs 294 and Hs 295.

Technical Data (Hs 293 A)

Designer office	Henschel Flugzeugwerke, Dr. Wagner's team.
Stage	Operational
Structure	A SC500 bomb
Wings and Tail unit	Aluminum structure and coating. Movable surfaces actuated by electrical controls.
Powerplant	A Walter 109-507 B with 600 kg (1,320 lb.) of thrust.
Propellant	T-Stoff and Z-Stoff (*)
Pressurizer	Compressed air
Warhead weight	295 Kg of HE
Guidance system	A wire guided Dortmund/Duisburg (FuG207 and FuG237)
Length	3.82 m (12 ft. 6 3/8 in.)
Span	3.10 m (10 ft. 2 in.)
Launch weight	1,045 kg (2299 lb.)
Range	18 km (9'7 NM)

(+) See Table 3


Henschel Hs 296
(operational) ★
Henschel Hs 295
(prototype)
Henschel Hs 294A
Heinkel He 343+Henschel Hs 295 ★
scale 1/72

OTHER DEVELOPMENTS

Technical Data (IIGs 294 A)

Stage Flying tests
Structure Steel with aluminum covering
Wings and Tail unit Aluminum structure and coating. Movable surfaces actuated by electrical controls.
Powerplant Two Walter 109-507 D with a joint thrust of 1,300 kg (2,860 lb.)
Propellant T-Stoff and Z-Stoff
Pressurizer Compressed air
Warhead 650 kg (1,443 lb.) of Amatol
Guidance system Radio controlled (wire guidance in the IIS-294 B and television guidance in the Hs-294 D
Length 6.114 m (20 ft. 1 3/8 in.)
Span 4.025 m (13 ft. 2 1/8 in.)
Maximum Diameter 0.620 m (2 ft. 3/8 in.)
Launch Weight 2,170 kg (4,774 lb.)
Maximum Speed 245 m/s (804 ft./sec.)
Range 17 km (9 NM)

Technical Data IIs 295

Stage	Prototype for acrodynamic tests
Structure	Steel covered by aluminum
Wings and Tail Unit	Aluminum structure and coating. Movable surfaces actuated by electrical controls.
Power plant	Two Walter 109-507 D with a joint thrust of 1,300 kg (2,860 lb.)
Propellant	T-Stoff and Z-Stoff
Pressurizer	Compressed air
Warhead	585 kg (1,443 lb. of H.E.)
Launch weight	2,090 kg (4,598 lb.)
Guidance system	Passive radar receiver
Length	5.44 m (17 ft. 10 1/8 in.)
Span	4.08 m (13 ft. 4 1/2 in.)
Maximum Diameter	0.58 m (1 ft. 10 4/5 in.)
Maximum speed	235 m/s (770 ft./sec.)
Range	4-14 km at 500 m-8000 m high

HENSCHEL "ZITTERROCHEN"

Whereas the projects IIs 294 and Hs 295 had the purpose of increasing the warhead's weight, at the expense of a double power plant, the „Zitterrochen" was designed to fly at high supersonic speeds. This was so due to the fact that its destructive power was intended to rest on its impacting kinetic energy, more than in its explosive charge (about 200 Kg).

Before massive production began in 1944, the project was canceled.

Technical Data (Zitterrochen)

Designer office	Henschel Flugzeugwerke, Dr. Voepl's team
Stage	Design
Structure	Light alloy
Wings and Tail Unit	Structure and coating of light alloy. Lift.ing actuated by elevator controlled by electrical controls. Roll control by Wagner bars.
Powerplant	Two Walter 109 of advanced design
Propellant	T-Stoff and Z-Stoff
Guidance system	unknown
Length	3.47 m (11 ft. 4 1/2 in.)
Span	1.51 (4 ft. 11 2/5 in.)
Maximum Diameter	0.37 m (1 ft. 2 1/2 in.)
Launch weight	unknown
Maximum speed	Mach 1.5

BLOHM UND VOSS BV 226 AND BV 246 "HAGELKORN"

These unpowered glider bombs were used to test different types of terminal guidance.

Version 226 had a characteristic cruciform tail unit, since it was expected to be used against shipping. It was self guiding by infrared sensors.

Version 246, radio guided, carried a smoke generator in a ventral position for the purpose of being visible to the operator in the launch plane.

Also, some units of the 246 "Radieschen" were built. They were fitted with an advanced path finder which homed the bomb onto enemy radar.

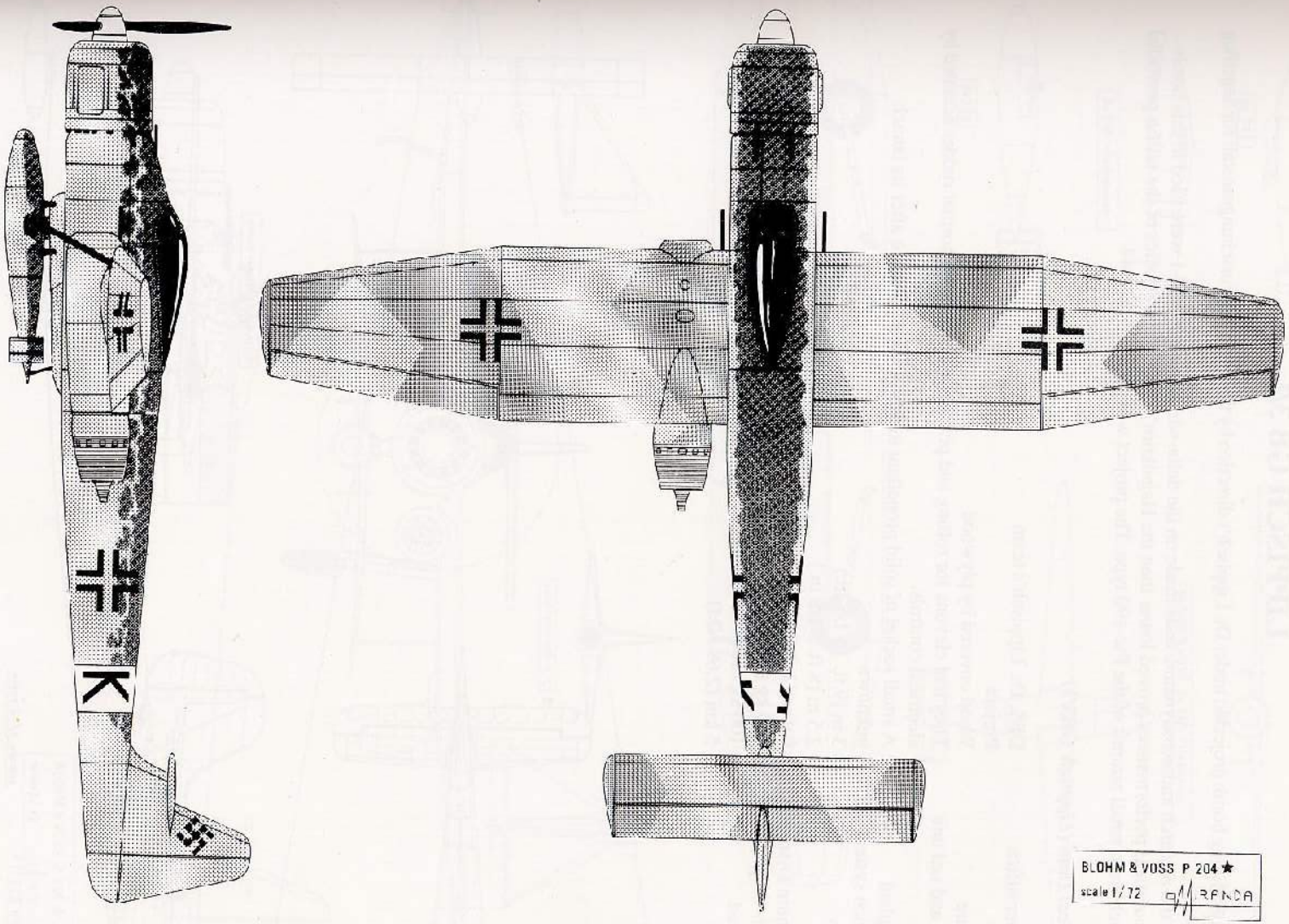
There were 1100 "Hagelkorn" made in Hamburg between December 1943 and February 1944, when the factory was destroyed by a raid.

An extensive test launching program was carried out by Heinkel He 111 H-6s and Focke Wulf Fw 190 A's in Karlshagen during 1944.

In spite of the good results obtained, production wasn't resumed, being considered a weapon easy to be interfered with by electronic means. It was planned to use the fighter-bomber BV P.204 as an operational launcher of these devices.

Technical data (BV 246 in brackets)

Stage	Flying tests
Structure	Metallic fuselage and tail unit. Wings of flexible die-cast concrete were drawn under the launcher plane, acting like springs in the launching sequence.
Guidance system	Infrared (radio or radar receiver)
Span	6.4 m /20 ft. 11 7/8 in. (6.4 m /20 ft. 11 7/8 in.)
Length	3.56 m /11 ft. 8 1/8 in. (3.52 m /11 ft. 6 5/8 in.)
Length	"Radieschen" 4.03 m (13 ft. 2 5/8 in.)
Height	0.65 m /2 ft. 1 1/2 in. (0.85 m /2 ft. 9 1/2 in.)
Launch weight	(730 kg / 1,609 lb.)
Gliding range	209 km (130 miles)
Launch height	10,500 m (34,450 ft.)
Warhead weight	435 kg (957 lb.)
Speed at target	450 km/h (280 mph)



BLOHM & VOSS P 204 ★
scale 1/72 ARANDA

LIPPISCH GB 3/L

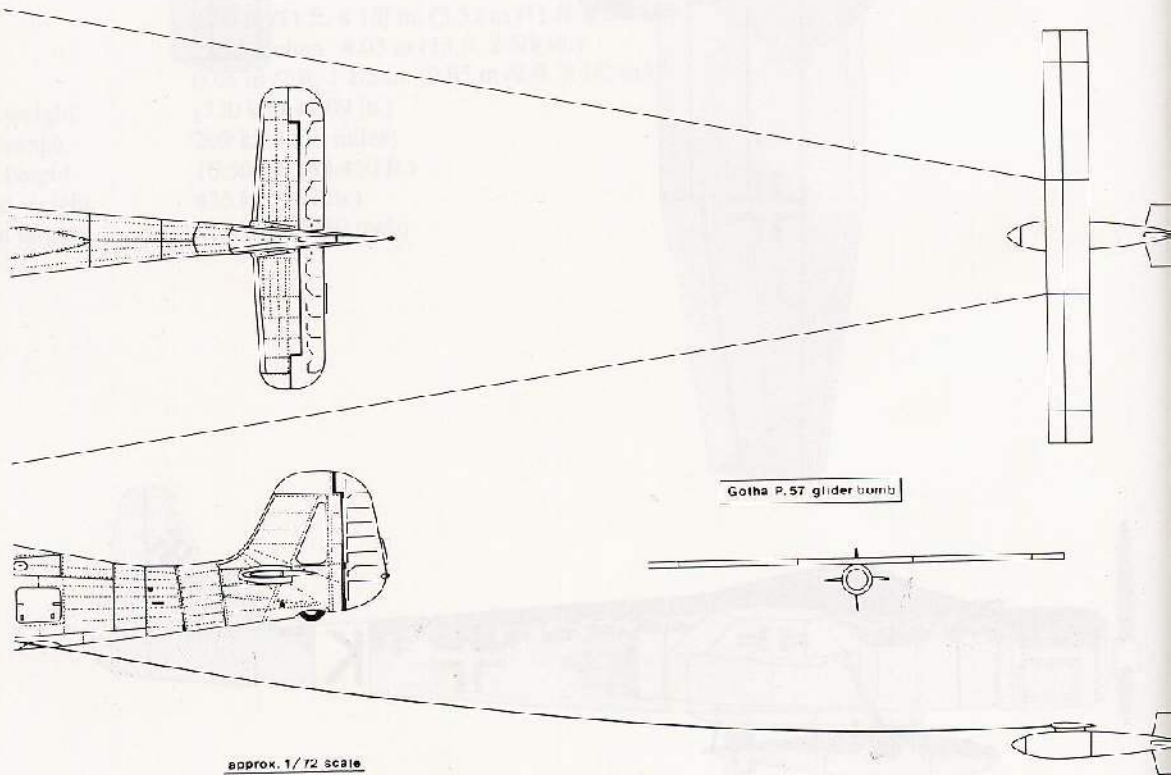
Small gliding bomb projected under Dr. Lippisch's direction by the Deutsche Forschungsanstalt für Segelflug (DFS).

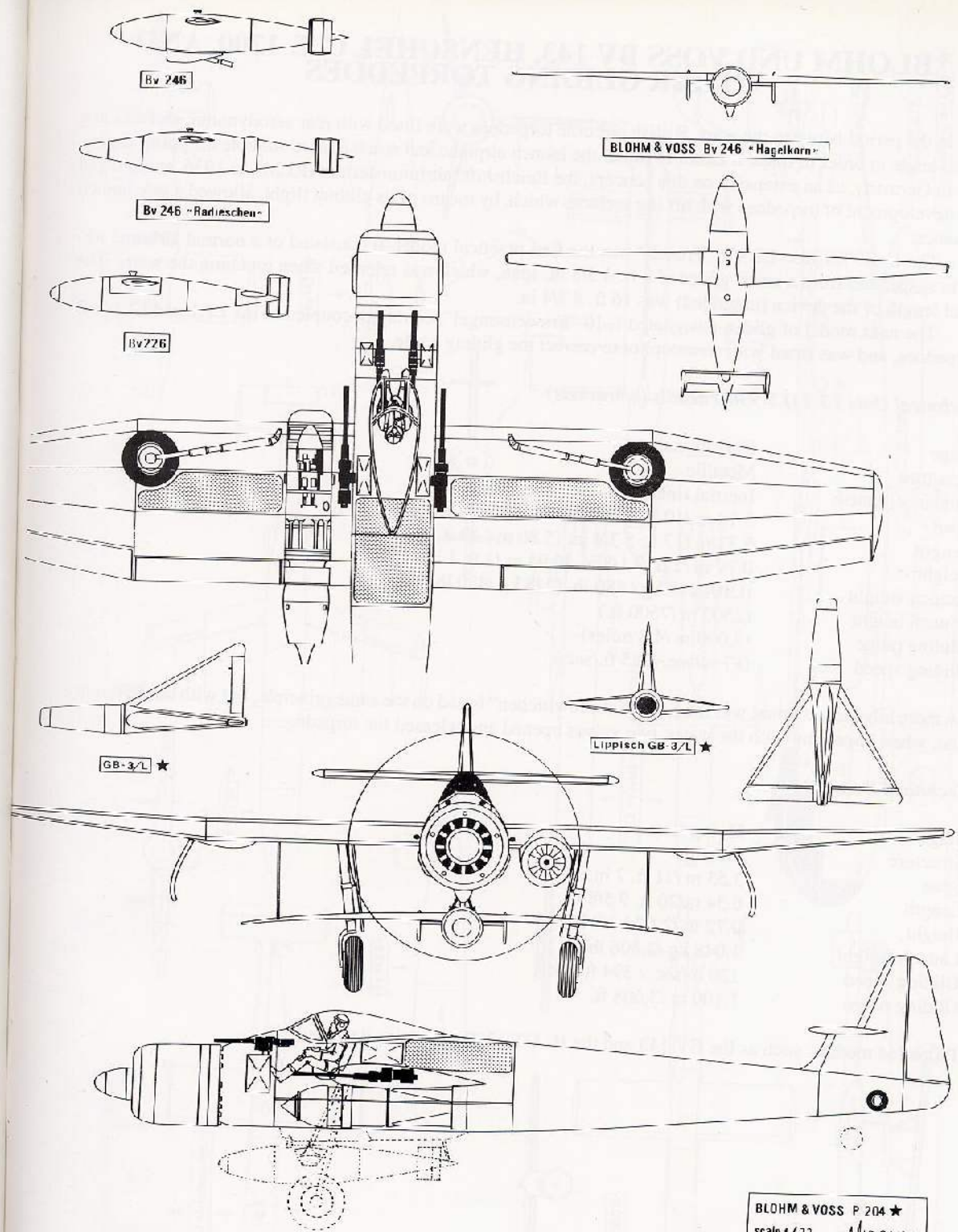
All the research and aerodynamic tests made on the delta-winged glider DM-1 were used in this bomb.

Theoretical performances proved lower than the Hagelkorn's, and characteristics of the tailfin prevented its launch from small aircraft of the Fw-190 type. The project was canceled in 1944.

Technical Data (Lippisch GB3/1)

Designer office	DFS, Dr. Lippisch's team
Stage	Project
Structure	Wood covered by plywood
Wings and tail unit	They had elevons for rolling and pitching control and a normal rudder actuated by electrical controls.
Powerplant	A small rocket of solid propellant to accelerate the device after its launch.
Guidance system	unknown
Length	3 m (9 ft. 10 1/8 in.)
Span	2.5 m (8 ft. 3 1/8 in.)
Maximum Diameter	0.4 m (1 ft. 4 7/8 in.)
Launch weight	250 kg (550 lb.)
Warhead	100 kg (220 lb.)
Range	5 km (2,69 NM)




Bv 246
Bv 246 «Radieschen»
Bv226
BLOHM & VOSS Bv 246 «Hagelkorn»
GB-3/L ★
Lippisch GB-3/L ★
BLOHM & VOSS P 204 ★
scale 1/72
MIRANDA
FEB 88

BLOHM UND VOSS BV 143, HENSCHEL G.T. 1200, AND OTHER GLIDING TORPEDOES

In the period between the wars, British airborne torpedoes were fitted with rear aerodynamic surfaces at a fixed angle in order to make it easier to repair the launch airplane and reach a more suitable dropping angle.

In Germany, as an extension on this concept, the Reichsluft.fahrtministerium (RLM), in 1936, encouraged the development of torpedoes with lift.ing surfaces which, by means of its gliding flight, allowed a safe launch distance.

- The Luft.-Torpedo LT 9'2 "Frosch" was the first practical model. It consisted of a normal airborne torpedo suspended from a small glider of 6 ft. 4 3/8 in. span, which was released when touching the water. The total length of the device (unguided) was 16 ft. 8 3/4 in.

- The next model of glider, designated L.10 "Friedensengel", could get coupled to the LT.1 and LT 950D torpedoes, and was fitted with an autopilot to correct the gliding angle.

Technical Data LT.1 (LT 950D details in brackets)

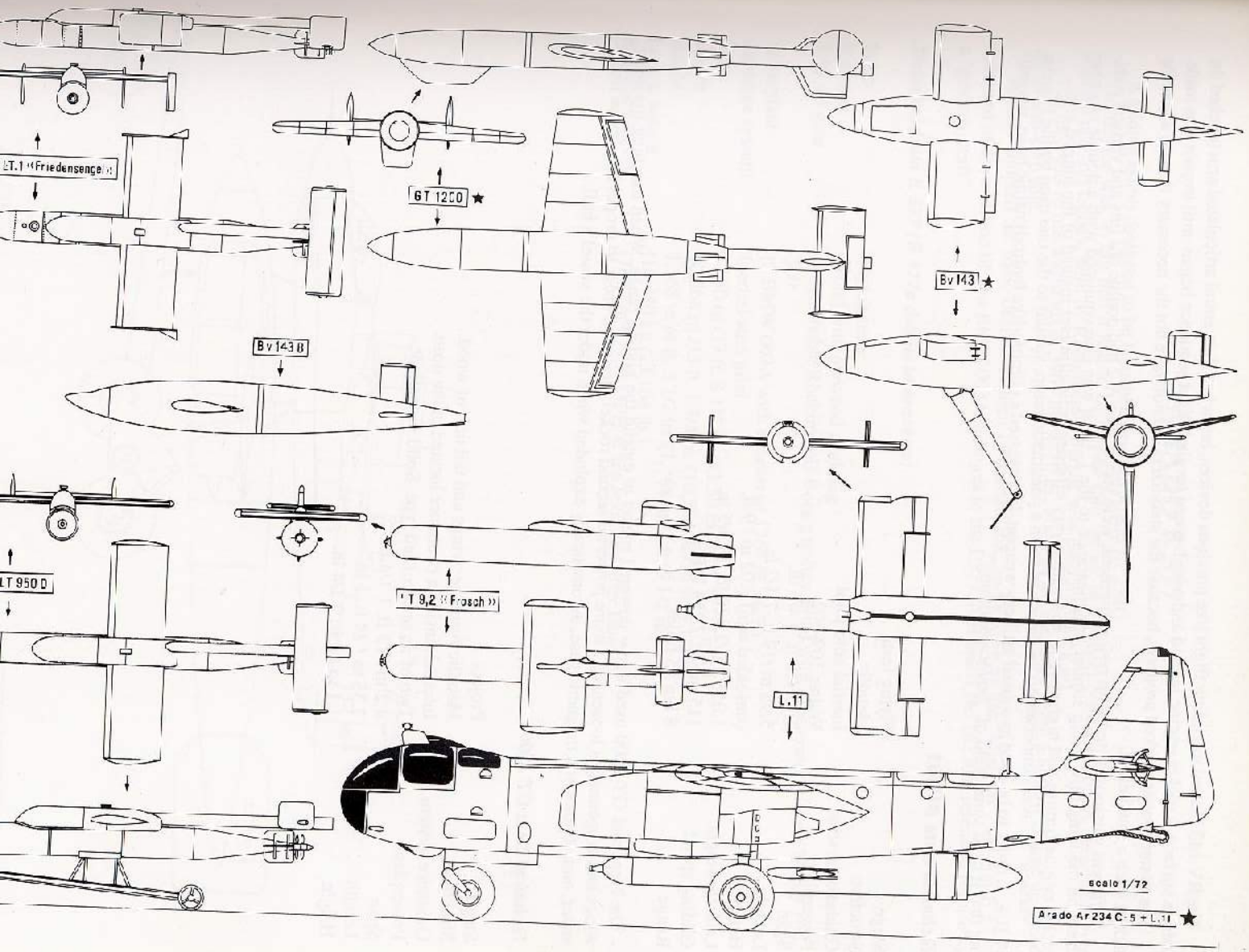
Stage	Operational
Structure	Metallic
Guidance system	Inertial (inertial)
Span	3.10 m /10 ft. 2 in. (3.30 m/10 ft. 9 7/8 in.)
Length	5.33 m /17 ft. 5 3/4 in. (5.80 m / 19 ft. 1/4 in.)
Height	0.79 m /2 ft. 7 1/8 in. (0.94 m /3 ft. 1 in.)
Launch weight	(L10) 218 kg / 480 lb. (218 kg /480 lb.)
Launch height	(2500 m /7500 ft.)
Gliding range	(9,000 m /4.8 miles)
Gliding speed	(87 m/sec. /285 ft./sec.)

- A more advanced variant was the L.11 "Schneewittchen" based on the same principle, but with the difference that, when impacting with the water, two valves opened and released the torpedo.

Technical Data L.11

Stage	Flying tests
Structure	Metallic
Span	3.53 m /11 ft. 7 in.
Length	6.34 m/20 ft. 9 5/8 in.
Height	0.72 m /2 ft. 4 3/8 in.
Launch weight	1,048 kg /2,306 lb.
Gliding speed	120 m/sec. / 394 ft./sec.
Gliding range	1,100 m /3,608 ft.

Propelled models, such as the BV 143 and the Hs GT-1200, were also designed.


LT.1 «Friedensengel»
GT 1250 ★
Bv143 ★
Bv143B
LT 950 D
T 9,2 «Frosch»
L.11
scala 1/72
Arado Ar 234 C-5 + L.11 ★

The BV 143 halved in gliding flight like previous devices, but when the ventral articulated arm touched the water's surface, a rocket engine ignited and a high speed leveled flight sequence began until impact was made.

The system never worked properly, because the stabilizers did not have not the necessary time to adjust the path at such a low height.

Different versions, fitted with new equipment, were tested. The A-2 had double tail fins and vertical stabilizers on the wing tips, being similar in appearance to the L.10. It was also equipped with a double chamber rocket engine (cruise and high speed), and with a very efficient radioaltimeter instead of the hinged arm.

Version "B" was conceived to be launched from a pneumatic ramp, similar to the one used by the Fieseler Fi 103, in order to be used as a coast artillery weapon. It possessed a dolphin-like hydrodynamic nose, suggesting that it used some kind of "bounce bombing".

Technical Data BV 143

Stage	Flying tests
Structure	Metallic
Guidance system	Inertial auto pilot
Powerplant	Walter 109-502
Span	3.17 /10 ft. 4 4/5 in.
Length	5.98 m /19 ft. 7 1/2 in.
Height	(unfolded arm) 3.02 m / 9 ft.
Launch weight	1,055 kg /2,326 lb. 10 4/5 in.
Gliding speed	115 m/sec. / 258 MPH
Range	8 km / 5 miles

- The Henschel GT-1200 used a low powered rocket to extend the gliding range. When touching the water, wings and empennages loosened, a more powerful second rocket ignited in order to propel the device underwater, and, thanks to a magnetic fuse, automatically exploded when under the vessel's hull.

Technical Data GT 1200

Stage	Project
Structure	Metallic fuselage, wings and tail unit of wood.
Guidance system	Intertial, inside a container located in the nose.
Powerplant	Two of an unspecified type. Solid propellant.
Span	4.2 m / 13 ft. 1 1/4 in.
Length	7.35 m / 24 ft. 1 in.
Height	1.1 m / 3 ft. 9 1/4 in.

ARADO E 377

A gliding bomb designed to be launched from an Arado Ar 234C.

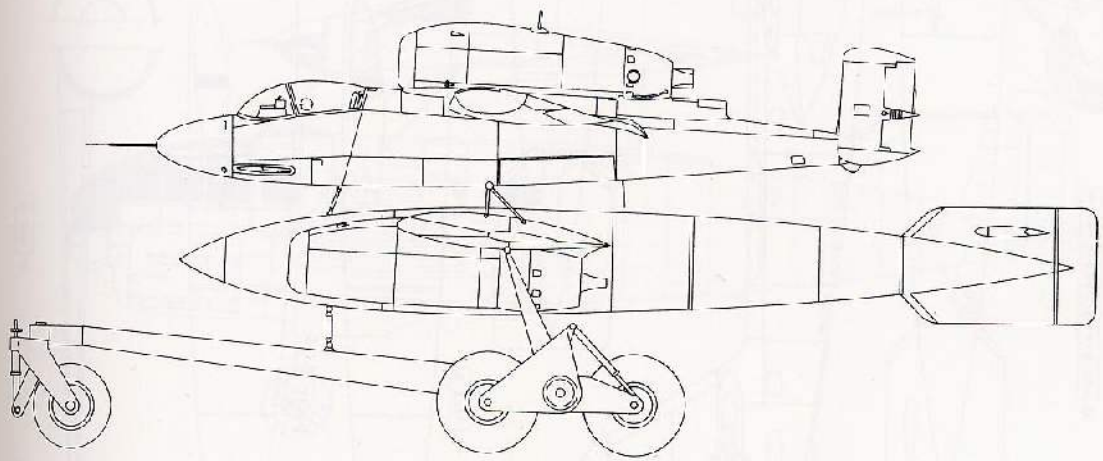
The device was so big that it had to be carried into the air in a Mistel configuration. A detachable five wheeled take-off trolley, built by Rheinmetall-Borsig, was used for taking off.

The idea was to use warheads of 3969 lb., 4410 lb., and 770 lb., the latter being a hollow charge designed for an anti-ship role.

Junkers adopted the basic design for their project Ju 268, also known as the "Mistel 6". Version E 377a consisted of the addition of two BMW 003A turbojets to the E377. A Heinkel He 162 was intended for use as a "guide aircraft".

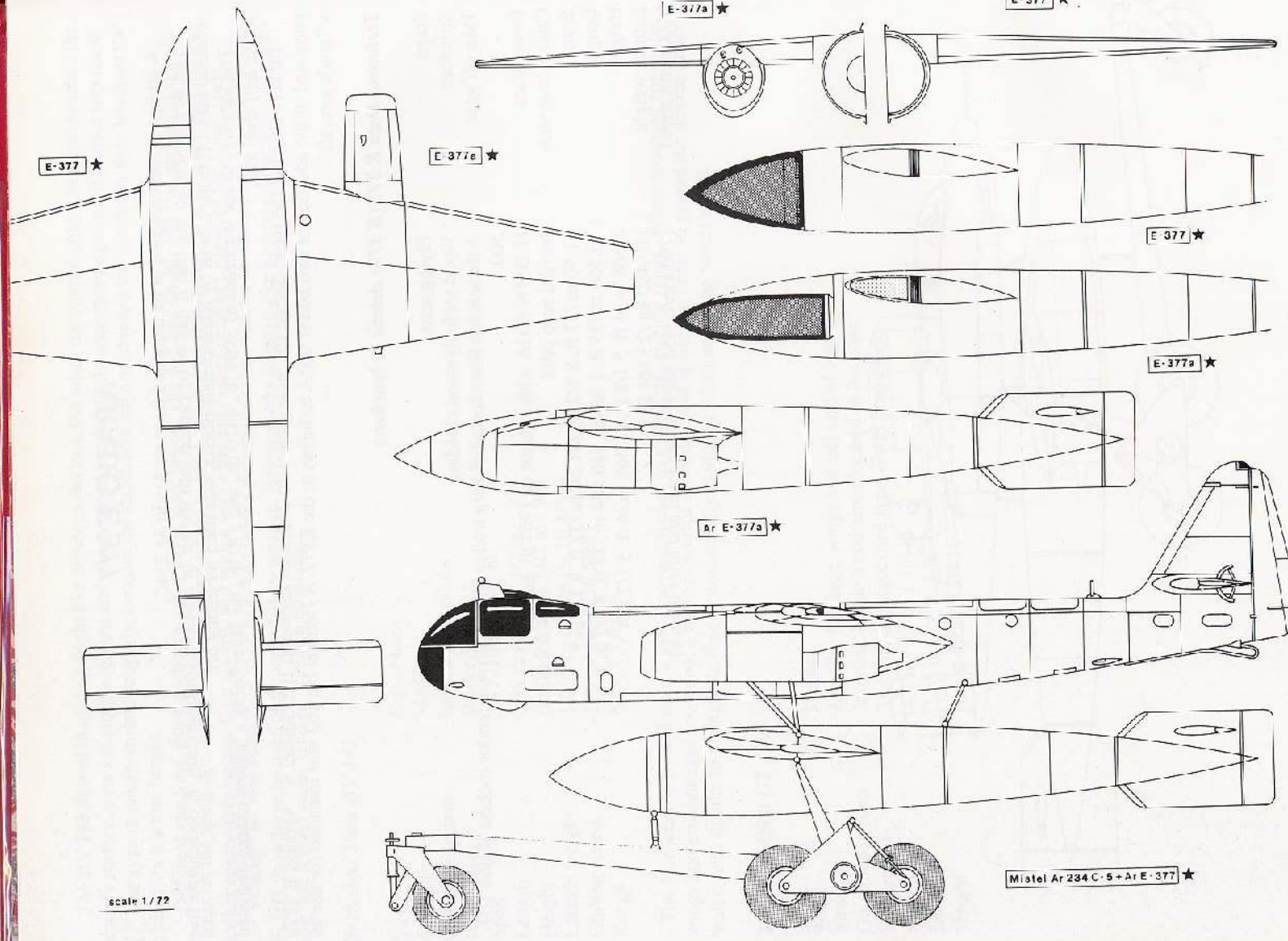
Technical Data E 377 (E 377a details in brackets)

Stage	Flying tests
Structure	Wood with plywood cladding
Take off gear	A detachable Rheinmetall-Borsig trolley fitted with accelerator rockets Walter 109-500
Powerplant	(2 BMW 003A with a thrust of 1764 lb. each)
Guidance system	Inertial auto pilot
Span	11.50 m /37 ft. 8 1/2 in. (11.50 m /37 ft. 8 1/2 in.)
Length	10,368 m /33 ft. 1 3/4 in. (10,584 m /34 ft. 8 1/2 in.)
Height	1,368 m /4 ft. 5 1/2 in. (1,368 m /4 ft. 5 1/2 in.)
Launch weight	(10,480 kg /23,104 lb.)
Maximum speed	(780 km/h /454 MPH at sea level and after launch)



scale 1/72

Heinkel He162 + Arado E377a


E-377a ★
E-377 ★
E-377 ★
E-377e ★
E-377 ★
E-377a ★
Ar E-377a ★
scale 1/72
Mistel Ar 234 C-5 + Ar E-377 ★

MISTELN AND OTHER COMPOSITE AIRCRAFT

German engineers studied, through several experiments carried out during the War, all possible configurations for two conventional aircraft assembled to form a composite flying machine.

The classical towing rope developed into the rigid bar, and this into the completely hinged "Schleppgerät" to form the flying configuration "Deichselschlepp", which was experimentally used by the He-177 A-3 to tow a winged propellant tank, and was foreseen for its operational use with the Ar-234B.

When the device transported by a bomber was bigger than the bomb bay (He-111 H-22 + Fi 103), it was externally fixed in a ventral position ("Parasit" configuration). If the new composite prevented the unfolding of the transport's landing gear, the unit was put on a takeoff trolley Rheinmetall-Borsig "Startwagen" propelled by rockets (Ar 234C+Fi 103). The series of devices "Schnellbombenträger", by Daimler Benz, was designed based on a "Parasit" system.

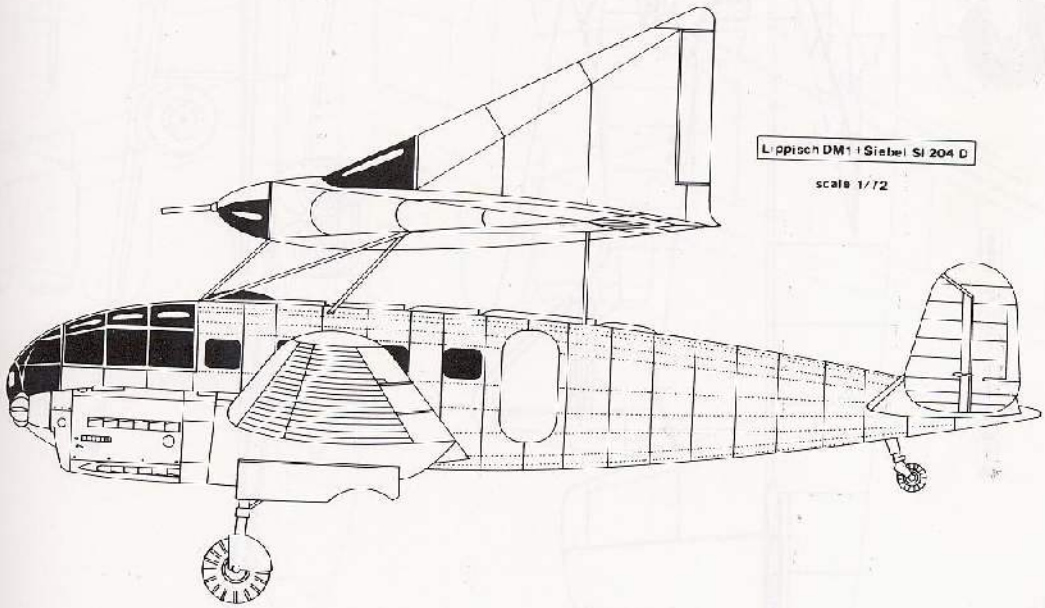
Another variation consisted of joining two aircraft of the same model by means of a common wing ("Zwilling"). The He 111Z was experimentally built following this principle, and there were very similar projects based on the Bf 109F(Bf 109Z) and the Me 309 (Me 609).

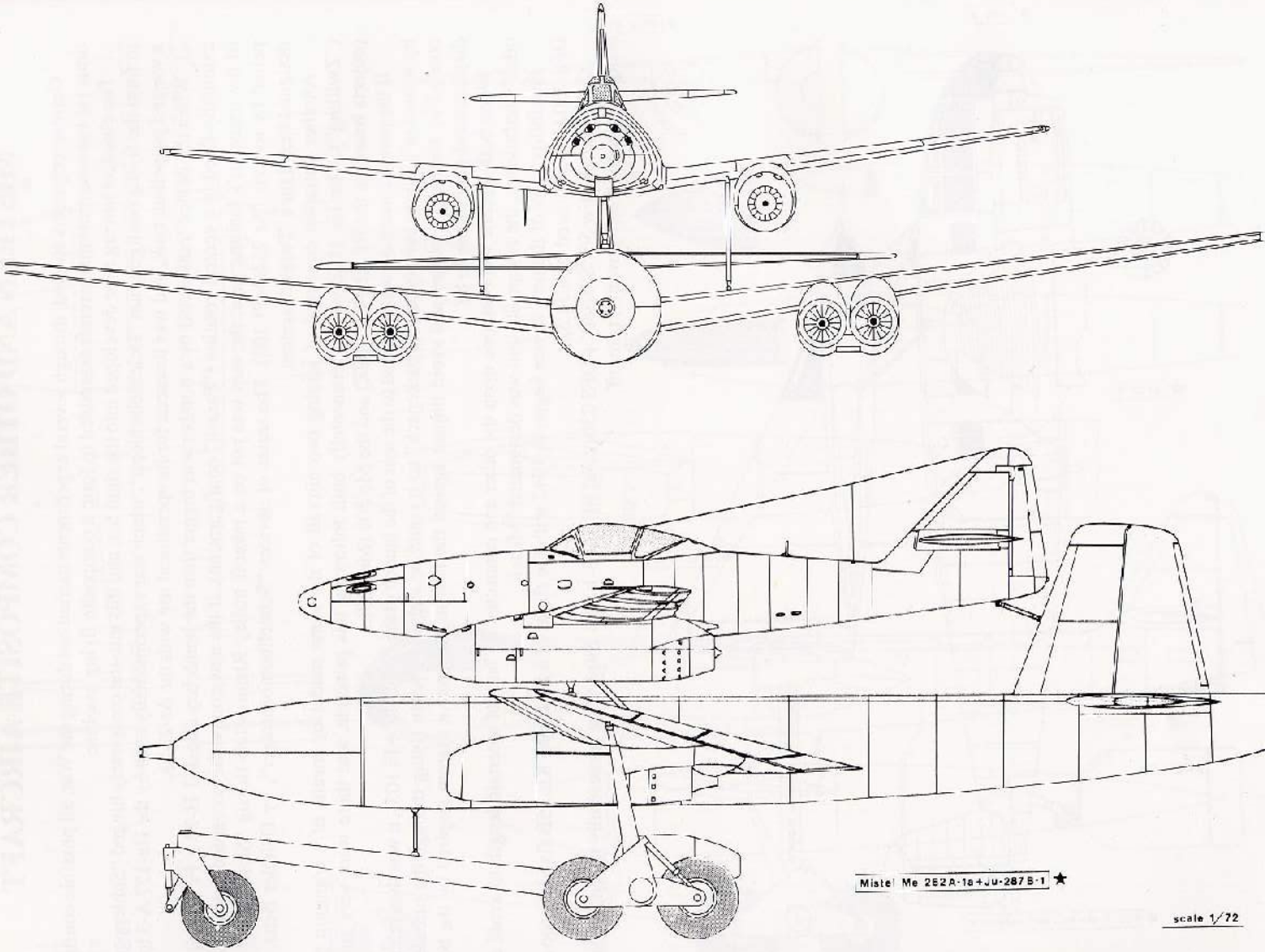
If the parasite machine was attached to the rear of the launch plane (Ar 234C + Fi 103), it was then released by means of a guide bars system "Huckepack" so it could be stabilized when flying through the turbulence created by the launch planes and avoid impact against the tailfin. This was a system inspired by the bomb displacement gear of the Ju 87.

When both aircraft were put one upon the other and connected by bars of a certain length to avoid each other's turbulence, the composite unit was designated "Mistel".

Feasibility tests of the new device began in 1942 with the flight of a KLEMM KL 35B fixed on top of a DFS 230A glider towed by a Ju 52.

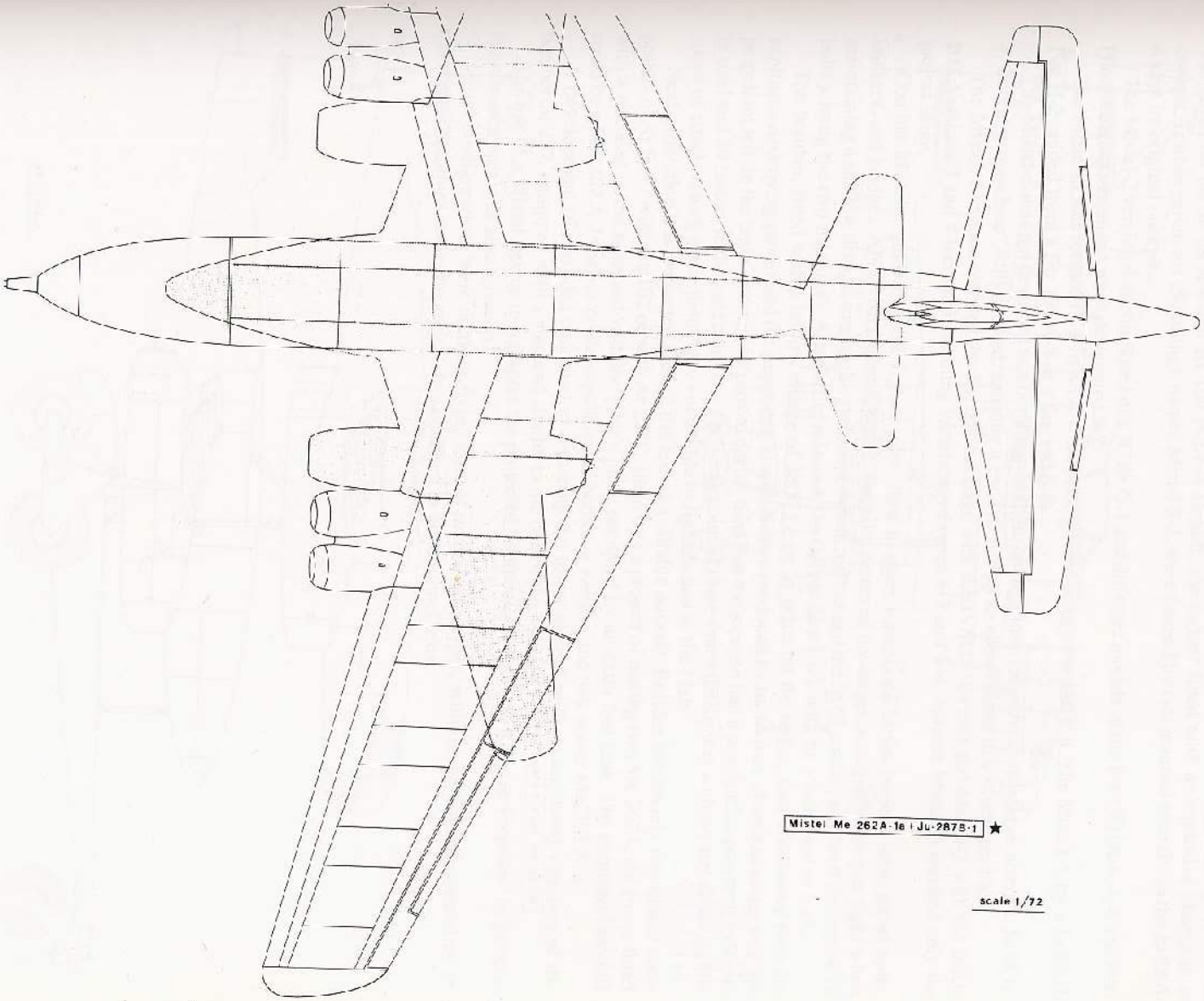
Combinations Fw 56 "Stösser" + DFS 230A and Bf 109 E-1 DFS 230A were successfully tested, the latest being capable of a self-powered take off.





Mistel Me 262A-1a+Ju-287B-1 ★

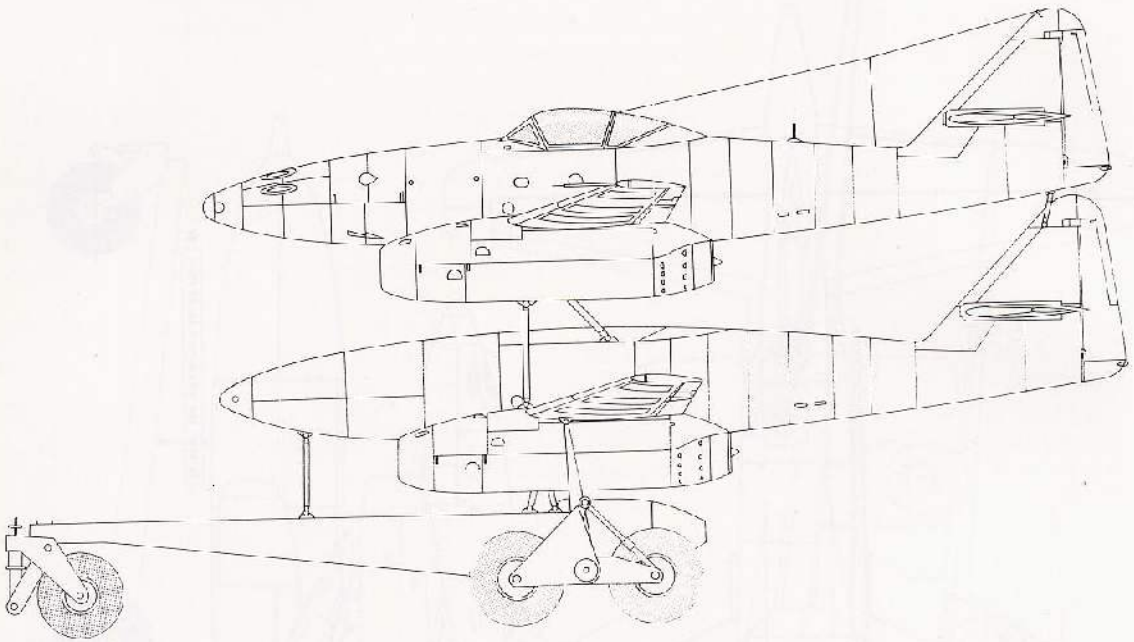
scale 1/72



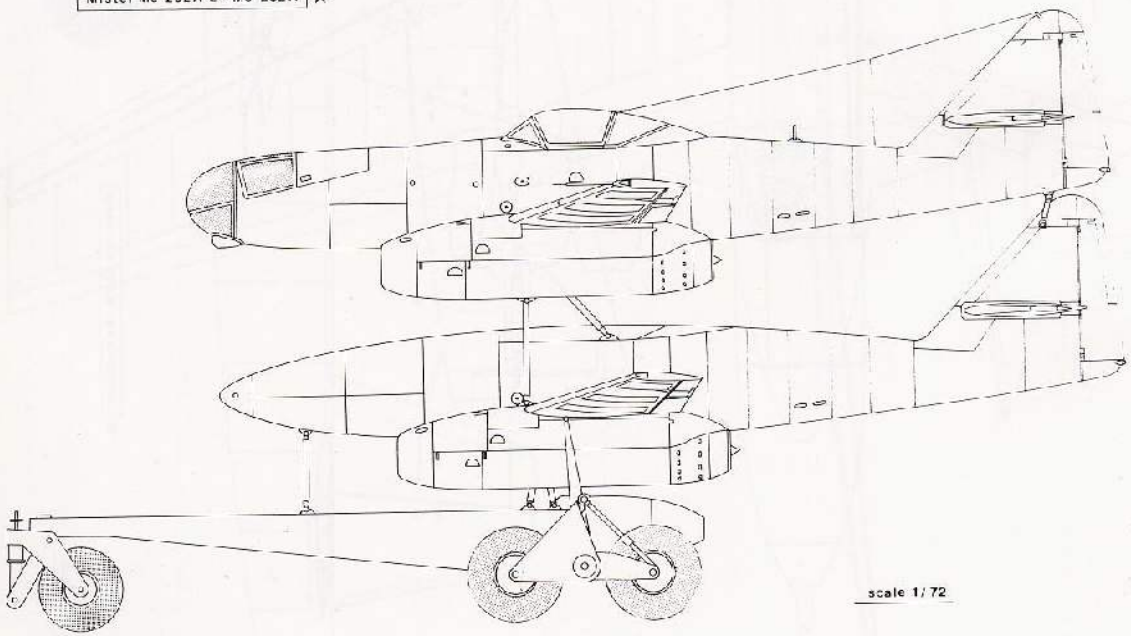
Mistel Me 262A-1a / Ju-287B-1 ★

scale 1/72

Mistel Me 262A-1a + Me 262A ★



Mistel Me 262A-2 + Me 262A ★



scale 1/72

From these experiments, a combat unit based on the Mistel-1 configuration was created in May 1944. This was based on the Ju-88 A-4 and Bf 109 F-2/F-4 aircraft, the former fitted with an explosive charge in its cockpit. Trainer variations (Schuling), named Mistel S-1, were formed by two manned aircraft, so the Ju 88 A-4 kept its original cockpit.

The Mistel-2 version was composed of a JU 88 G-1 and different models of the Fw 190 (A-6, A-8 and F-8). Piloted trainer variations were designated S-2.

The Mistel-3 was formed by a Ju-88 A-6 or A-6/U guided from a Fw 190 F-8. The Mistel-4, by a Ju-88 H-1 or H-2 guided from a Fw 190 A-8 or a Fw 190 F-8.

The Mistel-5 was not designed as a bombing weapon, but as a long range reconnaissance aircraft: Ju 88 H-4 "Führungsmaschine" fully crewed, carrying a Fw 190 A-8 as an escort plane in a Mistel position.

The Mistel-1 version reached the operational stage with the IV/KG 101 unit and Mistel-2 with the II/KG 200. Versions 3 and 4 were only training variations of types S-3 and S-4. Version Mistel-5 reached only the project stage.

Combat Misteln, guided by the fighter pilot, flew in open formations to the targets' area: naval units, bunkers, and bridges. After visual identification, the pilot centered the target in his reflector gun sight while maintaining a shallow dive, activated the gyroscope which maintained the Ju 88 course, and fired the explosive bolts joining the two machines. After being released, the fighter flew back with its whole load of fuel.

The bomber, fitted with a hollow charge of 3800 kg on its nose, hit the target, thus combining both the explosive destroying power and the impacting kinetic energy produced by its 14 tons of weight along with the propellant left in the tanks. It could be proved during tests that the weapon had a penetration power of 8 meters in steel and 20 meters in die-cast concrete. The weak point of these first Misteln was without any doubt its low speed of attack, which made them very vulnerable to fighters and to the Flak.

Next generation was projected around the fastest available aircraft. Besides the already mentioned composites of Ar E377 with He 162 or with Ar 234C, there was a project of mating two Me 262A, the lower fitted with a warhead in the nose and with the pilot's place occupied by an extra fuel tank. The command aircraft could be a Me-262 A-1a series or the sophisticated bombing version, the two-seater Me-262 A-2.

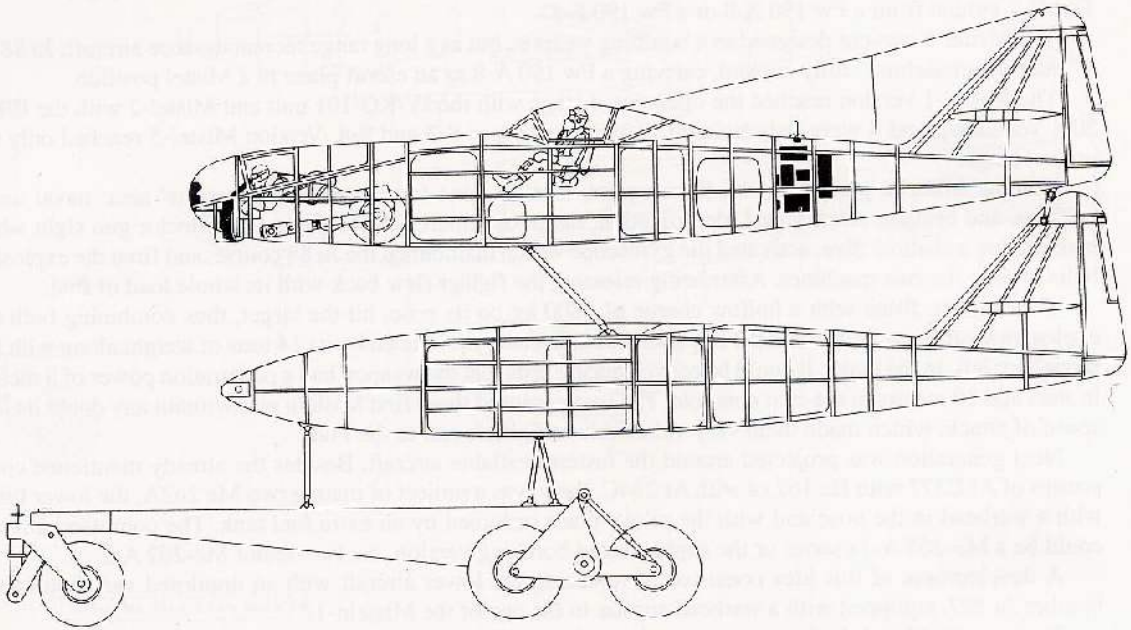
A development of this idea consisted of replacing the lower aircraft with an unpiloted variation of the bomber Ju 287, equipped with a warhead similar to the one of the Misteln-1.

The use of a Mistel device to transport the projected "Manuell Gesteuertes Raketen Projektil" to its optimum launch area was also foreseen.

Mistel configurations were used for flying tests of several prototypes, with the purpose of completing in real flight conditions some theoretical data obtained in wind tunnel tests.

Usually, a series of static flights with strain gauges fitted on a prototype's anchor points were made, to evaluate the control's behavior when in flight. Afterwards, the aircraft was released during a shallow dive, to clear by a safety margin the empennages of the carrier aircraft.

This system was also used to test the Lippisch DM-1 (on a Siebel Si 204D), the Me 328 V1, V2, and V3 (on a Do 217E), el DFS 228 (on a Do 217K), and the pulse jet Sänger (on a Do 217 E-2).



scale 1/72

Me 262 A-2+Me 262 A ★

FIESELER Fi 103

The great amount of losses experienced by the Luftwaffe during the Battle of Britain led the Germans to design less conventional attack weapons which were also more difficult to neutralize.

The pilots offered a solution consisting of a small guided plane, cheap, fast, and able to carry a considerable amount of explosives to London: "Projekt Fernfeuer".

The Army, on their part, suggested the development and series production of the monstrous ballistic missiles of the A4 series.

Both projects had their merits. The planes needed 280 man-hours for their construction (opposed to the 13,000 necessary for the rocket construction), cost between RM 1,500 and RM 10,000 (the rocket cost RM 75,000) and burnt a cheaper fuel, which could be easily obtained from the German lignite deposits (as opposed to the expensive propellants necessary for the rocket). The rejected Luftwaffe project would have been considered in peacetime, but the Army rockets couldn't be intercepted as they were detected by radar only in their final stage of flight and caused a ten times bigger destruction than their rivals, due to the enormous amount of accumulated kinetic energy.

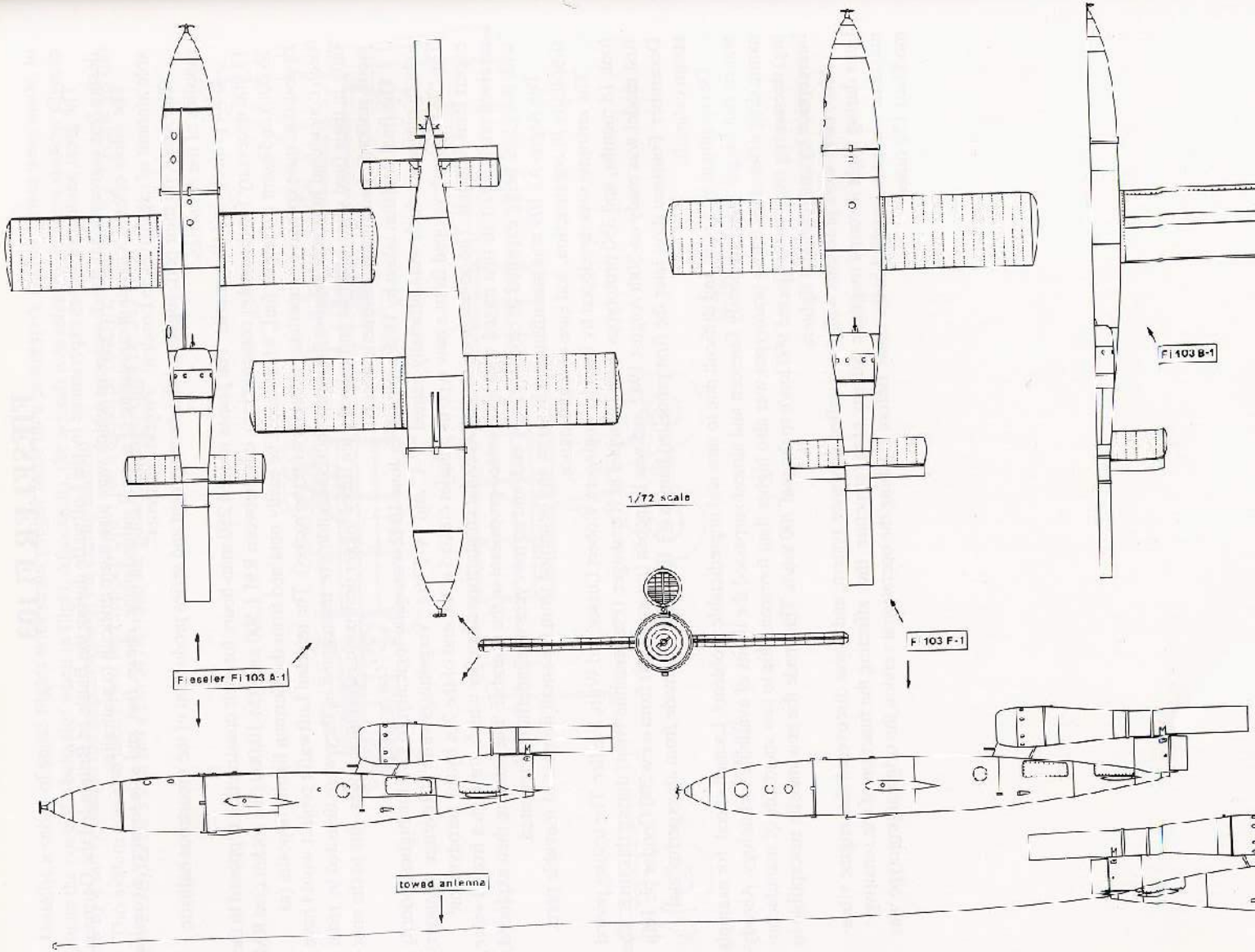
The final decision taken by Hitler himself in June 1942 was, quite logically, to give the highest priority to both projects, which were officially named "V-1" and "V-2" for "Vergeltungswaffe" (Revenge weapons). The "V-1" was developed from a new type of pulsejet created at the end of the 20s by the aerodynamic expert Paul Schmidt. The device consisted of a tubular combustion chamber which, through a frontal valve, received pressurized air that mixed with a vaporized propellant in the chamber. The mixture then exploded, with the gases being expelled through the back end, and so the cycle was indefinitely repeated.

The Argus As 109 was manufactured in series and benefited from the small number of movable parts, simplicity of construction, and ease of maintenance.

The airframe was developed by Fieseler engineers, Robert Lusser and Willy Fiedler. The testing period took 18 months, and 350 prototypes were launched in Karlshagen (Peenemünde West) during this time. The first model was ready on 30th August 1942 and was launched (unpropelled) from a Fw200 Condor on 10th December. Fourteen days later the first propelled launch (Fi 103 V12) was made from an experimental steam catapult.

Development was long and difficult due to new and unpredictable problems. Launch speed, for example, was in fact bigger than previously foreseen and almost surpassed the limits of available technology. Aerodynamic drag offered by flying prototypes was also higher than foreseen (due to low standards of manufacturing) decreasing from the projected 900 km/h to the real 700 km/h. This made the new missile susceptible to interception by conventional fighters.

Also, there were problems with the installed guidance system, and it was discovered that engine vibrations during flight inverted magnetic polarity of the structure, thus affecting the function of the sensitive magnetic compass installed in the nose. Before reaching the operational version the original prototype was modified 150 times.


1/72 scale
Fi 103 B-1
Fieseler Fi 103 A-1
Fi 103 F-1
towed antenna

32,000 units were manufactured and production was diversified among 50 different companies, the main production sites being at Nordhausen, Peenemünde (Fieseler), and in Fallersleben (Volkswagen).

The propaganda impact caused by this new way of making war was enormous, as is shown by the great amount of names and nicknames given to the machine: "V-1", for propaganda purposes, "Fi 103" by the manufacturer, "FZG 76" (Flak-Ziel-Gerät), and Targeting Device no. 76 by the Flak, which was a cover name for the German Intelligence Service. On their part, the crews of the launch units called them "Kirschkern" or "Krahe", and the population of Southern England called them "buzz-bomb" and "P-plane". For British interceptors, the radio code-name in pilot's talk was "Diver" and "Doodlebug".

Operational Routine

Launches were made from a ramp of concrete 42 m. long which pointed exactly to the target (usually a British town). The ramp had a tubular launching rail with a freely running inner piston, which was fitted to the lower part of the missile. In the rear end of the tube, a movable steam generator was fitted, containing two tanks of T-Stoff and Z-Stoff, three bottles of pressurized air, and an expanding chamber for the mixture.

Before shooting, one of the bottles was used to pressurize the system, forcing the mixture to dump the tube with highly pressurized steam and thus pushing the piston and the missile. When the latter had run half its path (+0.4 sec.), the other two air pressurized bottles went automatically into action to compensate the loss of Pressurizer in the tube. The piston was launched together with the missile, and was to be recovered.

Normal speed ejection was 110 m/sec. (360 ft./sec.), and the acceleration reached 16/17 Gs, preventing manned flights by this system.

On reaching the necessary speed, the pulsejet began to work, taking the missile to cruise ceiling. Course was kept by the magnetic compass and the inertial auto pilot. Deviations from course were corrected by means of rudder impulses generated by pneumatic actuators. The pressurizing system consisted of two spherical bottles of compressed air made of gum and covered by a wired mop of steel.

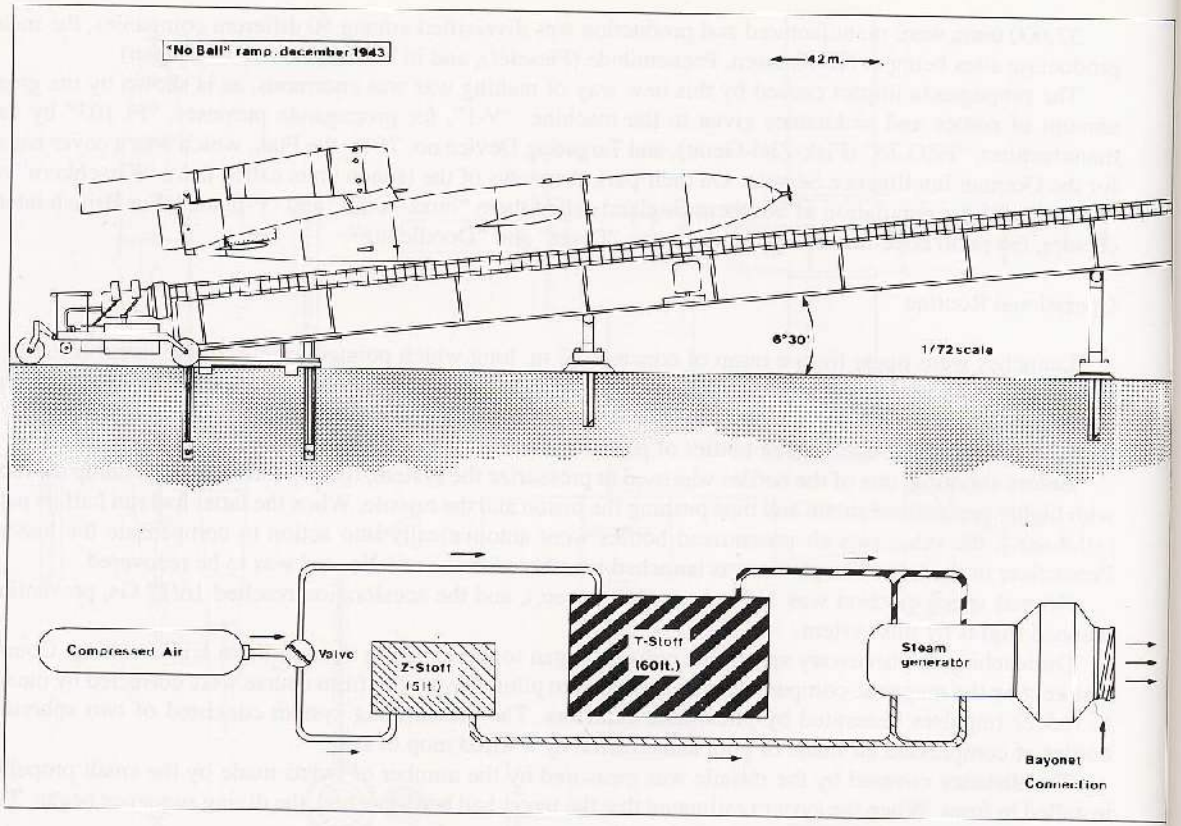
The distance covered by the missile was measured by the number of twists made by the small propeller installed in front. When the system estimated that the target had been reached, the diving sequence began. The elevator was reinforced by means of small spoilers.

The propellant did not cut off automatically, as some authors have pointed out. The pulsejet stopped when the diving angle reached 60 degrees. Although the propellant system was pressurized by the air of the reserve bottles, it was not sufficient to counteract the propellant weight.

The explosive charge ignited by impact thanks to two conventional fuses. In some case the bomb carried propaganda leaflets which were spread out by the explosion.

Some "V-1" had a radio range finder to help the launch crew to calculate the results before adjusting the autopilots for the next salvo.

The missile so fitted towed after it an antenna of 1,200 m., which tensed by means of a little aerodynamic brake.



THE RAMPS BATTLE

It was initially planned to build eight centres for missile storage, three big installations able to stock and launch, and ninety six 42 m launch ramps distributed in a strip of land 25 km. along the French coast, between the Cherbourg Peninsula and the Calais Straits, thus being the biggest concentration located in the Somme-Seine area.

In September 1943 there were 58 ramps fitted for launching and 32 more in stock. The British Intelligence Service was informed at that time by French spies that six of these sites existed. Photographic reconnaissance missions over northern France were ordered to Squadron nos. 2 (Mustang Mk III), 4 (Mosquito P.R.IV), and 16 (Spitfire P.R. Mk XI) of the R.A.F., where 52 ramps were detected and given the denomination "No-Ball site" by the British.

In December 1943 the intensive raid named "Operation Crossbow" began. It was carried out by the Bomber Command and the VIII Air Force with 3,000 tons of explosives to bomb the discovered installations.

At the end of January 1944, 25% of the ramps had been destroyed and two thirds of the French workers who had been building them had died or defected. This operation detracted 40% off the Allies' bombing resources, but finished with this menace temporarily.

After "Operation Crossbow", the Germans designed a rebuilding plan based on three big storage bunkers and 100 launch ramps of 21 m. which were called "Sky Sites" by the R.A.F. They were profusely camouflaged against aerial reconnaissance and built by German workers for more discretion. A typical launch installation was equipped, apart from the ramp and the catapult, with storage tanks of hydrogen peroxide and water for decontamination purposes, "S" shaped bunkers with a capacity for about 20 missiles, assembling building, launch control, air-raid shelter, and an external perimeter with actuated and guarded entrance.

Some sites had as many as three ramps, and still others were situated near the old installations that were repaired to attract enemy bombers, and all of them were strongly defended by Flak.

The unit in charge of the launch was named (as an Intelligence covering) Flak Regiment 155(W), and was under the command of colonel Max Wachtel. These troops belonged to the Luftwaffe, although they were under the organic control of the Wehrmacht, commanded by Lieut-General E. Heinemann of the XV Army Corps, based at Maison Lafitte. The regiment had 3500 men divided in 5 battalions, each one with two supply and four combat companies able to shoot as many as 64 missiles at a time.

In June 1944 a launch campaign against England began under the offensive known as "Rumpelkammer Operation".

The first general launch took place on 13th June 1944 (with 64 "Sky Sites" already built). Although 10 V-1 were launched that day, due to different causes only four reached England.

During the following days 244 more launches were made. From these, 45 failed and 75 hit London.

Until the end of the war, 8,892 V-1 were ground launched. 7,488 of them took off properly, 3,530 reached their targets, and 2,419 fell over London.

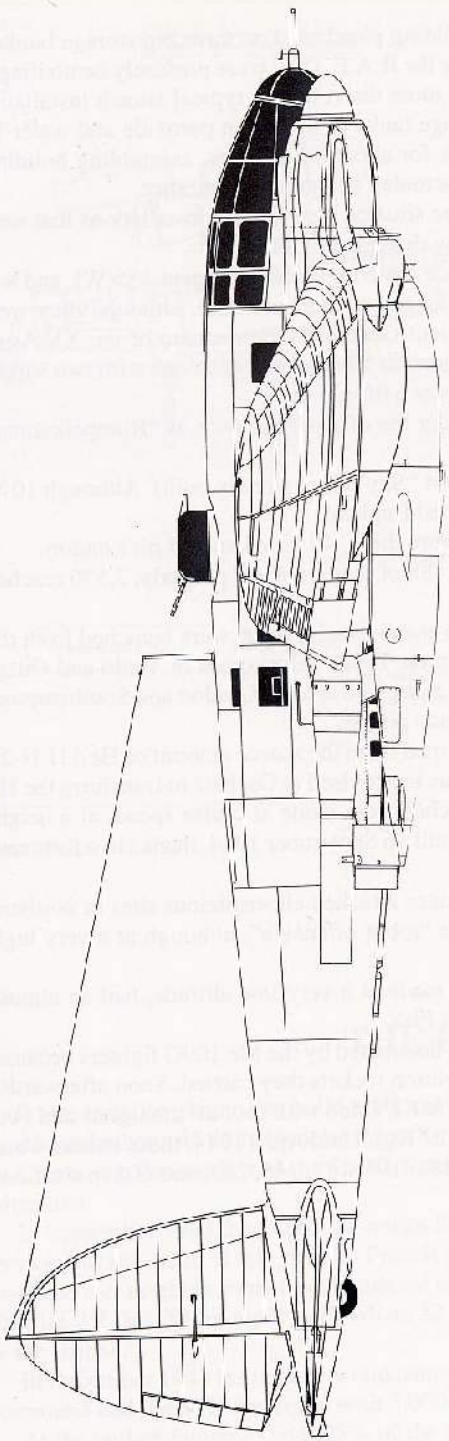
At the beginning of 1945, 2,488 more V-1s reached Antwerp and Brussels. 1,600 were launched from the air by the 100 He 111 H-22 of the III/KG 3 and I/KG53 based in the Dutch aerodromes of Venlo and Gilze-Rijen. These incursions began on 7th July 1944, and were mainly addressed against London and Southampton. They went on until 15 January, 1945, and cost the loss of 80 launch planes.

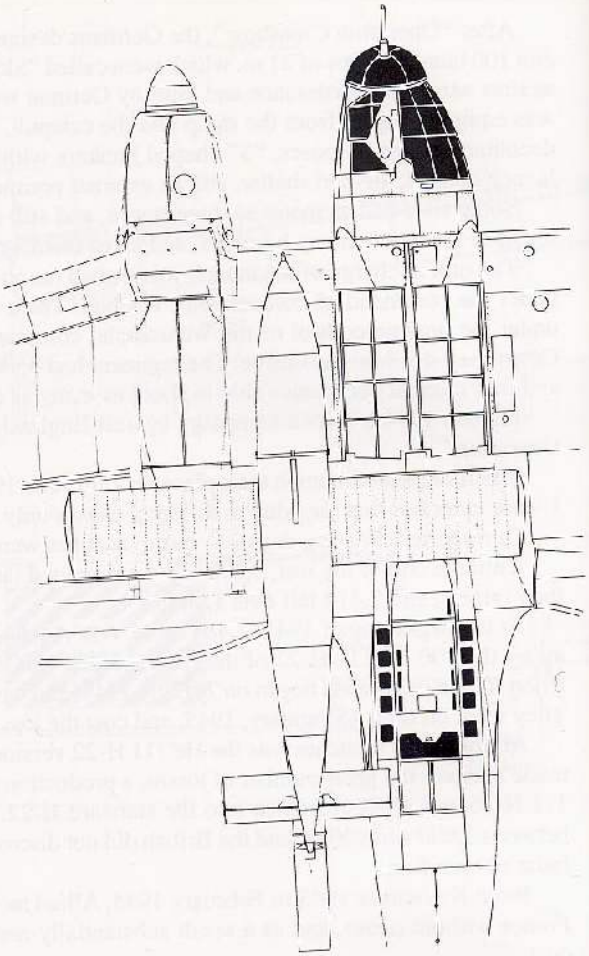
Although the launcher was the He 111 H-22 version, transformed from the scarce amount of He 111 H-21 made to cover the great number of losses, a production facility was improvised at Oschatz to transform the He 111 H-16 and H-20 airframes into the standard H-22. The launches were made at cruise speed, at a height between 3,000 and 500 m. and the British did not discover them until 16 September 1944, thanks to a fortunate radar observation.

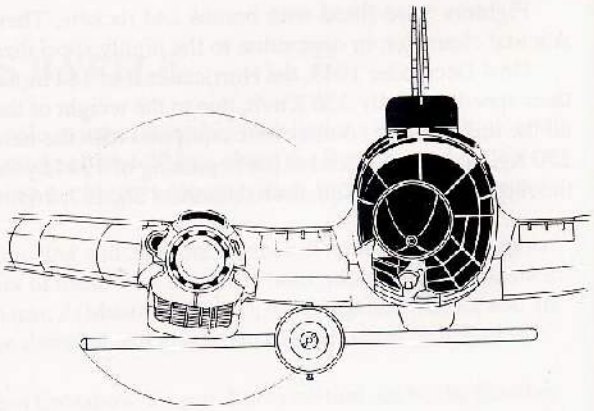
From November 1943 to February 1945, Allied tactical airplanes attacked all suspicious sites in northern France without pause, and as a result substantially restrained the "robot offensive", although at a very high cost.

Fighters were fitted with bombs and rockets. These attacks, made at a very low altitude, had an almost suicidal character, in opposition to the highly specialized German Flak.

On 4 December 1943, the Hurricanes II of 184 Squadron were decimated by the Me 109G fighters because their speed was only 320 Km/h, due to the weight of the six demolition rockets they carried. Soon afterwards, all the units sent to combat were equipped with the new Typhoon MKI, fitted with four 20 mm. guns and two 250 Kg. bombs (replaced at the beginning of 1944 by 8 rockets of 27 Kg). Until April 1944, these attacks were the responsibility of Squadrons numbers 56, 137, 164, 174, 181, 183, 193, 197, 245, 263, and 603 in rotation.







Heinkel He 111 H-22 + Fi 103

scale 1/72

The Spitfire Mk IX B of Squadrons numbers 33, 66, 124, 412 (Canadian), and 504 also took part in the battle. They were fitted with a single 250 Kg. bomb, which they launched without aiming, achieving quite poor results.

From the 5th of June 1944, the Mosquitos FB VI of Squadrons numbers 23, 515, and 605 added to the "No Ball attacks" with the rockets used to support the Allied landing in Normandy. The troops, in their advance, occupied the launch installations, reducing their threat to very occasional raids by the He 111 He-22.

Between January and March 1945 a Waffen SS regiment operated from a base in Delft., launching 300 missiles of two versions, series F-1 against England and series B-1 against the invader troops in the continent.

THE FLYING BOMBS BATTLE

The defense plan organized by the British between 13 June and 5 September 1944 to face the "robot offensive" was formed by four lines of defense: two coastal areas, one covered by long range airplanes which operated from the southeast of England to a line near the French coast, an inner area (between the coast and London), where radar sensors and A.A.A. were located and covered by high performance interceptors guided by centralized controls and, finally, the urban areas protected by balloon barriers.

- The Mustang Mk III of Squadron nos. 129 (66 missiles shot down), 306 (Polish), and 313 (Polish), and the day-patrol Mosquito FB Mk VI of the 418 Canadian Squadron operated in the outward perimeter. By night, the following airplanes took part in the operation:

The Mosquito NF Mk XII of Squadron nos. 29 and 465 (Australian), the Mosquito NF Mk XII of the 488 Squadron (New Zealander), the NF Mk XIII of Squadron nos. 96 (49 shot down), 264, and 409 (Canadian), the NF Mk XVII of the 125 Squadron, the NF Mk XVIII of Squadrons 25 and 68, the NF Mk XIX of the 157 Squadron, and the Northrop P-61 A-5 "Black Widow" of American Squadrons 422nd and 425th (9 shot down). The total number of victories reached by every type of Mosquito during "Diver Operation" was 430.5.

- Along the coast, between Dover and Hastings, the British installed 3,000 anti-aircraft pieces formed by the 40 mm, before Mk 1 automatic guns and the 3.7 inch Mk 1 and Mk 6. They were guided by the M-9 American radar and fired from a distance of less than 2,000 m (by means of a proximity fuse).

- The Spitfire Mk IX of Squadron nos. 1 (47 V-1 shot down), 165, 274, 453 (Australian), and 610 operated in the inner area, as well as the Spitfires Mk XV of 41 Squadron (52 shot down).

The most remarkable performance was displayed by Tempest Mk V interceptors from Squadrons nos. 3 (146 V-1 shot down), 56, 80, 274, 486 (New Zealander), and 501. In total, the Tempest V's crews destroyed 649.5 flying bombs, the most distinguished fighter-pilot being J. Barry with 61 victories.

Another thirteen V-1 were shot down by meteors Mk I of 616 Squadron. The defenses reached their highest efficiency during the night of 27 August 1944, when from the 97 missiles detected by radar, 87 were destroyed (62 by the Flak, 19 by fighters, and 6 by balloon barriers). The "V-1" was very difficult to intercept due to its high speed and small size. The fighters fitted with 20 mm guns, which normally fired from a distance of 400 m, had to approach to 100 m in the case of the "V-1", thus risking being trapped by the shock wave produced by the missile explosion.

To avoid this, a Mosquito FB VI of the 418 Squadron destroyed a V-1 crossing the missile's path just in front of it, forcing the V-1 to fly through the fighter's turbulence where the flying bomb lost control. On the contrary, Dean, a flying officer of the 616 Squadron, stroked the missile's wing with the meteor's wing tip (in a roll maneuver) and destroyed it by decontrolling the gyroscopes.

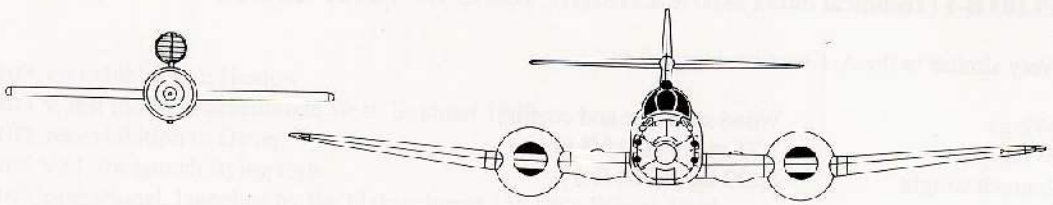
Since the V-1's were camouflaged, it was very difficult to distinguish them from the landscape when over land. When over the sea, at a low altitude, the estimated height when in a dive left. very little margin to pilots. By night, the outburst of the pulsejet gave false measurements (a P-61 shot down a "V-1" only 30 m from its nose).

The surviving missiles used to cross the English coast between Bexhill and Folkestone, flying at 600 km/h and at an altitude of 500 m, and oscillating between 300 and 2,500 m. Penetration speed varied from 550 to 650 km/h.

During "Operation Diver", from the 3,957 missiles destroyed, 1,785 of them were shot down by fighters.

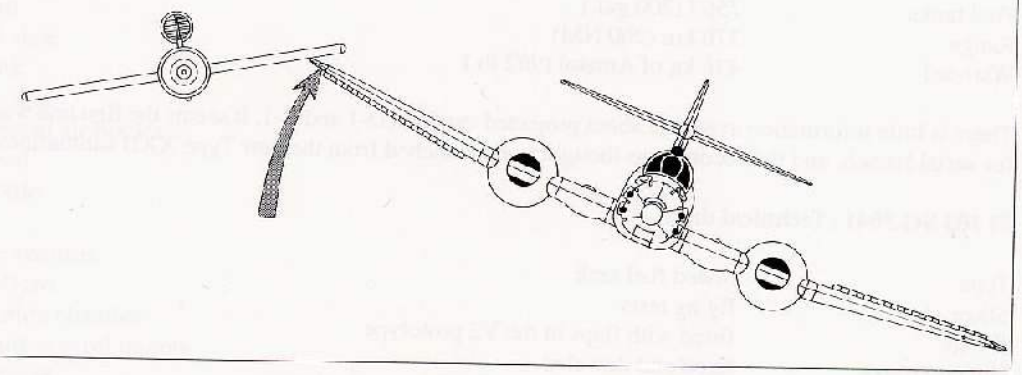
Fi 103 A-1 (Technical data)

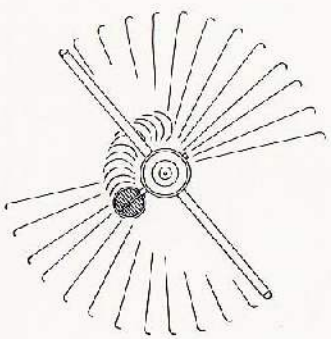
Stage	operational
Type	Cruise missile of medium range
Wings	Metallic structure and coating, without ailerons. Single tubular spar.
Fuselage	Metallic structure and coating made of stamped steel ribs and a melded steel plate 2 mm thick
Tail unit	Metallic structure and coating. Elevator fitted with spoilers to help final diving over the target.
Powerplant	An Argus As 109-014 pulsejet with a starting thrust of 366 kp and 254 kp at 3,000 m (9,840 ft.), and with a frequency of operation of 47 Hz.
Propellant	80 octane petrol, burning 1 U.S. gallon per mile.
Fuel tanks	one of 568 lt (150 gal.) located in the fuselage at wing level and pressurized by compressed air.
Warhead	830 kg (1,832 lb.) of Amatol with two impact fuses and, in some cases, with wooden coating.
Guidance	gyroscopic auto pilot Askania, anemometer, air-log device measurer and gyroscopic compass, tail controls controlled by two compressed air bottles and a 30 V battery.
Wingspan	5.37 m (17 ft. 7 1/2 in.)
Length	8.32 m (17 ft. 3 5/8 in.)
Height	1.42 m (4 ft. 7 7/8 in.)
Launch weight	2,152 kg. (4,750 lb.)
Launch maximum speed	400 km/h (216 NM)
Cruising speed	644 km/h (348 NM)
Ceiling	2,625 m (8,610 ft.)
Range	25 min (238 km/h / 128 NM)
Special equipment	some units towed an antenna of 1,219 m (4,000 ft.) and a transmitter to measure impact distance, others carried propaganda leaflets which spread out when the charge exploded.

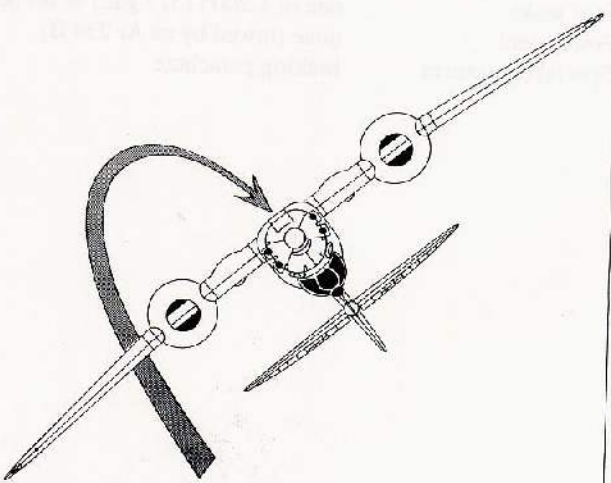


Gloster Meteor Mk.I versus F.103 (11th August 1944)

1/100 scale







Fi 103 B-1 (Technical data)

Very similar to the A-1 version except for:

Wings	Wood structure and coating
Wingspan	5.73 m (19 ft. 9 5/8 in.)
Launch weight	2,132 kg (4,704 lb.)

Fi-103 B-2 (Technical data)

Similar to the A-1 version except for:

Stage	Test
Warhead	SC1800
Launch weight	3,122 kg (6,892 lb.)

Fi-103 F-1 (Technical data)

Similar to the A-1 version except for:

Fuel tanks	756 l (200 gal.)
Range	370 km (200 NM)
Warhead	436 kg of Amatol (962 lb.)

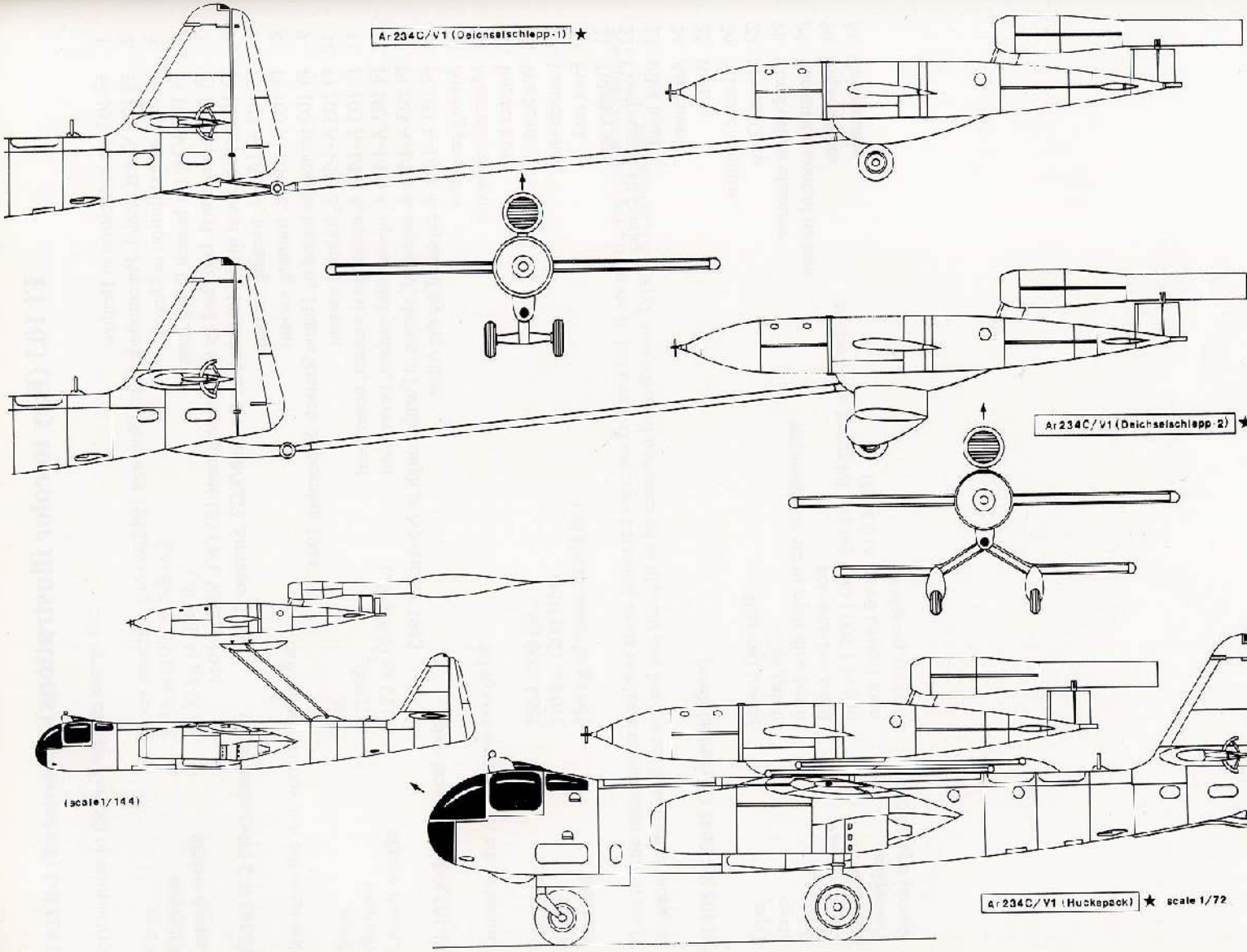
There is little information available about projected versions D-1 and E-1. It seems the first one was optimized for aerial launch, and the second was thought to be launched from the new Type XXII submarines.

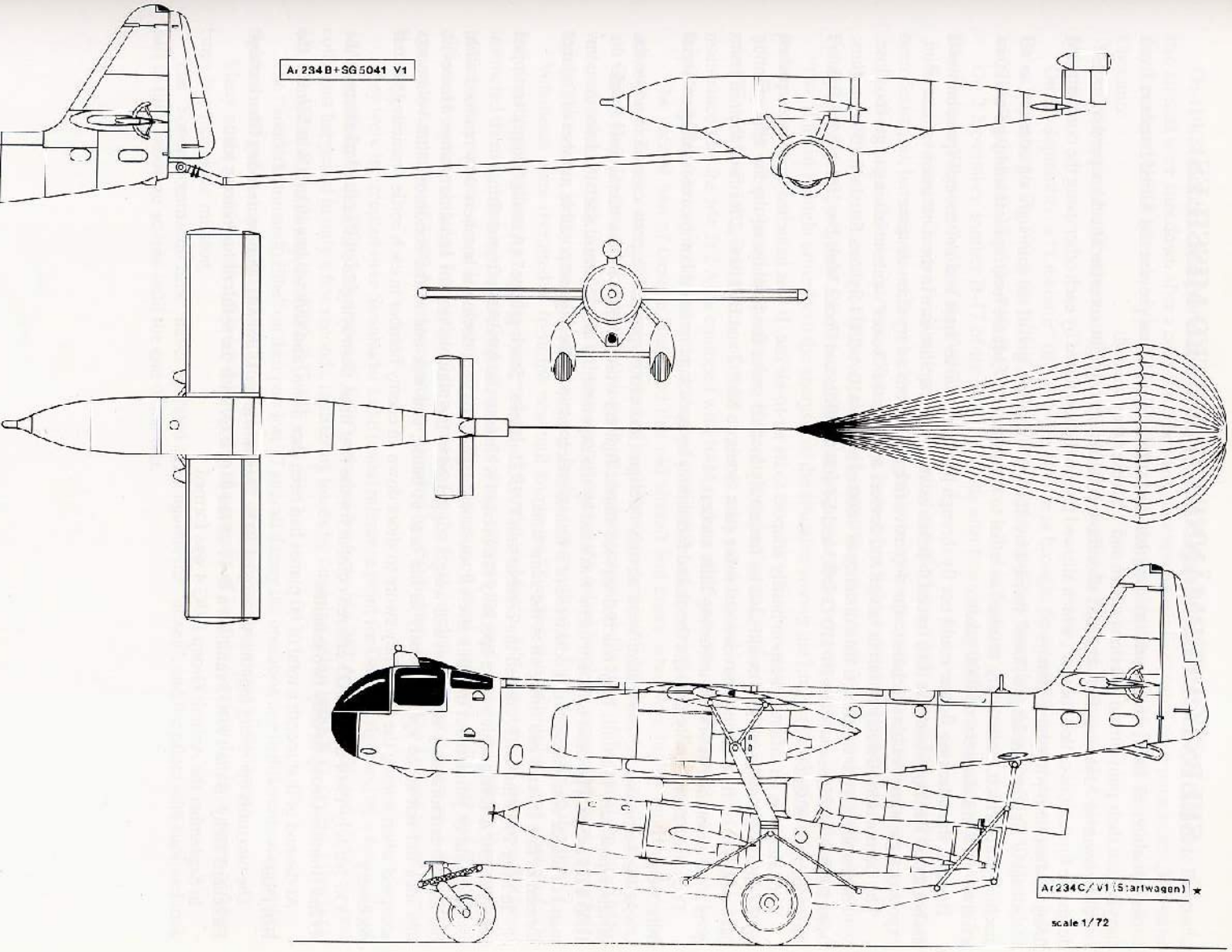
Fi 103 SG 5041 (Technical data)

Type	towed fuel tank
Stage	flying tests
Wings	fitted with flaps in the V2 prototype
Undercarriage	fixed and doweled
Fuel tanks	one of 1,200 l (317 gal.) of B4 petrol of 87 octane
Powerplant	none (towed by an Ar 234 B)
Special equipment	braking parachute

Fi 103 (Key to color illustrations)

1. Fi 103, on exhibition in Henlow
2. Fi 103 V, test model, Peenemünde West. Summer 1942
3. Fi 103, on exhibition in Dover
4. Fi 103 V33, for launch flying tests
5. Fi 103, operational, launched by the Flakregiment 155 (W). Winter 1944
6. Fi 103, operational model launched by the Stab/KG3. Summer 1944
7. Fi 103 A-1/Re 1, training variant
8. Fi 103 A-1/Re 2, training variant
9. Fi 103 prototype tested by Hanna Reitsch. September 1944
10. Fi 103 A-1/Re 3, training variant
11. Fi 103 A-1/Re 4, operational variant, never used
12. Fi 103 A-1/Re 4, operational variant, never used
13. Fi 103 A-1/Re 4, captured, shown at Farnborough in November 1945
14. Fi 103 A-1/Re 4, captured by the Allies
15. Air-log propeller
16. Magnetic compass
17. Impact fuses
18. Warhead
19. Launch shoe
20. Fuel tank
21. Tubular spar
22. Compressed air bottles
23. Pilot head
24. Air throttle
25. Battery
26. Mixture venturis
27. Master Gyro
28. Combustion chamber
29. Pneumatic control motors
30. Impact fuses
31. Cable cutter


Ar 234C/V1 (Deichselschlepp-1) ★
Ar 234C/V1 (Deichselschlepp-2) ★
(scale1/144)
Ar 234C/V1 (Huckepack) ★ scale 1/72


Ar 234 B+SG 5041 V1
Ar234C/V1 (Startwagen) ★
scale 1/72

SELBSTOPFERMÄNNER (PILOTED MISSILES)

In the winter of 1943, it was quite evident that the Luftwaffe could not prevent the Allied bombers from carrying out their punishment missions where and whenever they wanted.

The powerful American four-engined aircraft, specialized in daylight accurate attacks, operated in self-defensive formations called "boxes", which allowed them to be supported by each other using the concentrated firing of their heavy machine-guns.

A lonely fighter attacking a "box" formed by 15 B-17 bombers got in the gun sight of as many as 40 machine-guns which, statistically, resulted as lethal to the target of 17 square feet, represented by a Fw 190 in a frontal view at a distance of 1000 yards.

Besides, the attacking fighter could not fly through the formation as there was not enough space between the bombers. The aggressor was then forced to finish its attack with a close turn in the most inconvenient point, exposing a great part of his machine to the defensive fire made from a very short distance.

The Germans tried many different tactics and devices to break the "boxes" without having to get too close.

The bombers were attacked from a distance of 1800 m by Me 410 A-2/U4 fighters fitted with 50 mm guns; from 1300 m by Messerschmitt Bf 110 G-2/R3 and Bf 109 G-6/R2; and Focke Wulf Fw 190 A-7/R6 fighters equipped with W.Gr21 rockets.

The latter was an infantry weapon hastily adapted to its air-to-air use. It was launched from tubes placed under the wings, although they could also be frequently located under the fuselage of the Fw 190, pointing backwards, to be fired after a conventional firing pass. Some Ju 88 P-2 and Bf 110 G-2/R1 fired their 37 mm guns from a distance of 900 m, achieving little success.

They tried another way to brake the closed formations by parachute retarded bombs, resembling an aerial mine field.

At the beginning of 1944 there were already designs and prototypes of weapons created to solve the distance problem, but until they reached service status, fighters were ordered to risk themselves inside the 1000 yard range. The most efficient tactic was used by the experimental unit "Sturmstaffel-1" under the command of major von Kornatzki. It consisted of a frontal attack made by the biggest possible number of fighters formed in line abreast and firing all at the same time.

In May 1944 the OKL created the combat unit IV/JG3 named "Sturmgruppe" (Assault Group), equipped with Fw 190 A-8/R2, which were specially armored to withstand the American frontal firing.

It should be pointed out that this aircraft was not designed to shoot down the bombers they rammed with, but that its extraordinary sturdiness and weight suggested to the pilots its use for aerial rammings. However, this idea did not surge spontaneously in the heat of battle, and was one of the conditions that volunteers accepted when joining the unit. They swore to shoot down an enemy bomber in each sortie "ramming them if necessary".

On 7th July 1944 the IV/JG3 entered combat for the first time, destroying 23 "Liberator" bombers of the 492nd Bomber Group in only two minutes.

At the end of that month a total of 60 planes had been shot down, and another assault unit was formed, the II/JG300.

The two units operating together destroyed 40 B-17 bombers on 15 August, and the next day Oberleutnant Ekkehard Tichy of the IV/JG3 rammed a B-17 of the 91st B.G. with the result of both crews lost.

In September the Assault Group II/JG 4 was formed.

On 11th September, during an attack made by the IV/JG3 against the B-17 of the 100th B.G. over Eisenach, two aircraft were shot down after a collision. The two pilots saved their lives using their parachutes. The same day Leutnant Alfred Lausch of the II/JG IV died when charging against one B-17 of the 96th B.G. over Chemnitz.

On 13 September, Oberleutnant Walther Dahl destroyed a B-17 by ramming it. He baled out with his parachute.

On 27 September, a "Liberator" of the 445th B.G. was brought down over Eisenach by impact with the Heinz Papenberg's Fw 190 of the II/JG 4. On 7 October, Leutnant Klaus Bretschneider of the II/JG 300 launched his plane against a B-17 of the 94th B.G., destroying it.

On 2 November another B-17 of the 91st B.G. was also brought down after a ramming attack made by Oberleutnant Wernher Gerth of the IV/JG3.

When the Assault Groups finalized operations at the end of March 1945, almost 500 Allied bombers had been destroyed, but only ten of them had been brought down by the ramming procedure.

The Germans suffered more than 150 casualties. Even more fighters were lost in combat.

Besides the risky character of these attacks, the fact that they were made by very well armed and armored Fw 190, mostly inappropriate for maneuverable combat, made them very expensive in lives and equipment.

Two lines of thought arose from the analysis of the situation among the Luftwaffe officers involved in the problem.

- The first one proposed the production of the most technologically advanced aircraft possible, with new scientific achievements, and the use of these airplanes with conventional interception tactics (Adolf Galand maintained that the Me 262 A-1a equipped with R4M rockets of 55 mm was the ideal combination). At least they should be able to practice ramming with good possibilities of surviving (Zeppelin "Rammer").

- The second line of thought suggested that old aircraft and crews who were highly motivated by the atmosphere of the moment ("Selbstopfermänner") could make a successful combination for tactical purposes.

Oberst Hajo Herrmann thought that flying schools had no purpose at this stage of the war (February 1945), and persuaded Goering to send every airborne aircraft against the Allied bombers, crewed by very young half-trained pilots who, in any case, wouldn't have any further opportunities to fight the enemy in the air.

Volunteers were recruited to form the new unit known as "Sonderkommando Elbe", and a total of 200 enthusiastic youngsters met at the flying school of Stendal in March. Old members of the Assault Group instructed them in ramming tactics (impact against a wing, between the engines, or even striking the bomber's tailfin with your own propeller) during 10 days. The planes used were a mixture of Bf 109 and Fw 190 of different versions obtained from other flying schools for the final combat. This took place on 7 April 1945 against a formation of 1300 American bombers escorted by 850 fighters in flight to Dassau across German territory.

They were intercepted over Steinhuder Lake (usual reference point for German fighters) by a formation of 183 aircraft from the "Sonderkommando Elbe" escorted by forty Me 262 A of the JG7 and JG54. Several collisions happened in only a few seconds, registering losses by ramming of the 100th B.G. (1), the 338th B.G. (2), the 452nd B.G. (3) and the 490th B.G. (2).

The "Sonderkommando Elbe" on their part lost 77 aircraft during the operation due to different causes: Allied fighters, navigational mistakes, forced landings, and the generally inexperienced pilots' errors.

Many of the surviving aircraft were destroyed in the process of landing the next day by a group of Mustangs in a free chase mission.

The "Sonderkommando Elbe" never operated again against the "boxes", and the pilots who survived took part in little sabotage actions until the end of the war.

BLOHM UND VOSS BV40

A small armored glider built with a minimum frontal section to penetrate in the 1,000 yards area covered by the heavy machine guns of American bomber formations.

Designed by doctor Richard Vogt to be built by non-qualified personnel using non strategic materials, it was proposed to the RLM in the middle of 1943.

Production plans included 19 prototypes and 200 airplanes of series BV 40A, but when the project was abandoned in Autumn 1944, only six machines had been manufactured. Use of the BV 40 required the help of a towing airplane (Bf 109G) to take off from a detachable trolley and be towed to the combat area at 6,000 m altitude.

Once released, the tiny fighter made its first attack diving against the "boxes" at a 20 degree angle, ignoring the defensive fire and firing its two 30 mm guns from a very short distance. When in favorable circumstances, the accumulated kinetic energy allowed a second attack, using either the guns or the "Gerät-Schlinge" device. The latter consisted of a towed explosive charge which gave the BV 40 the status of a piloted missile. After combat, the plane glided to a suitable landing site using flaps and a ventral skid.

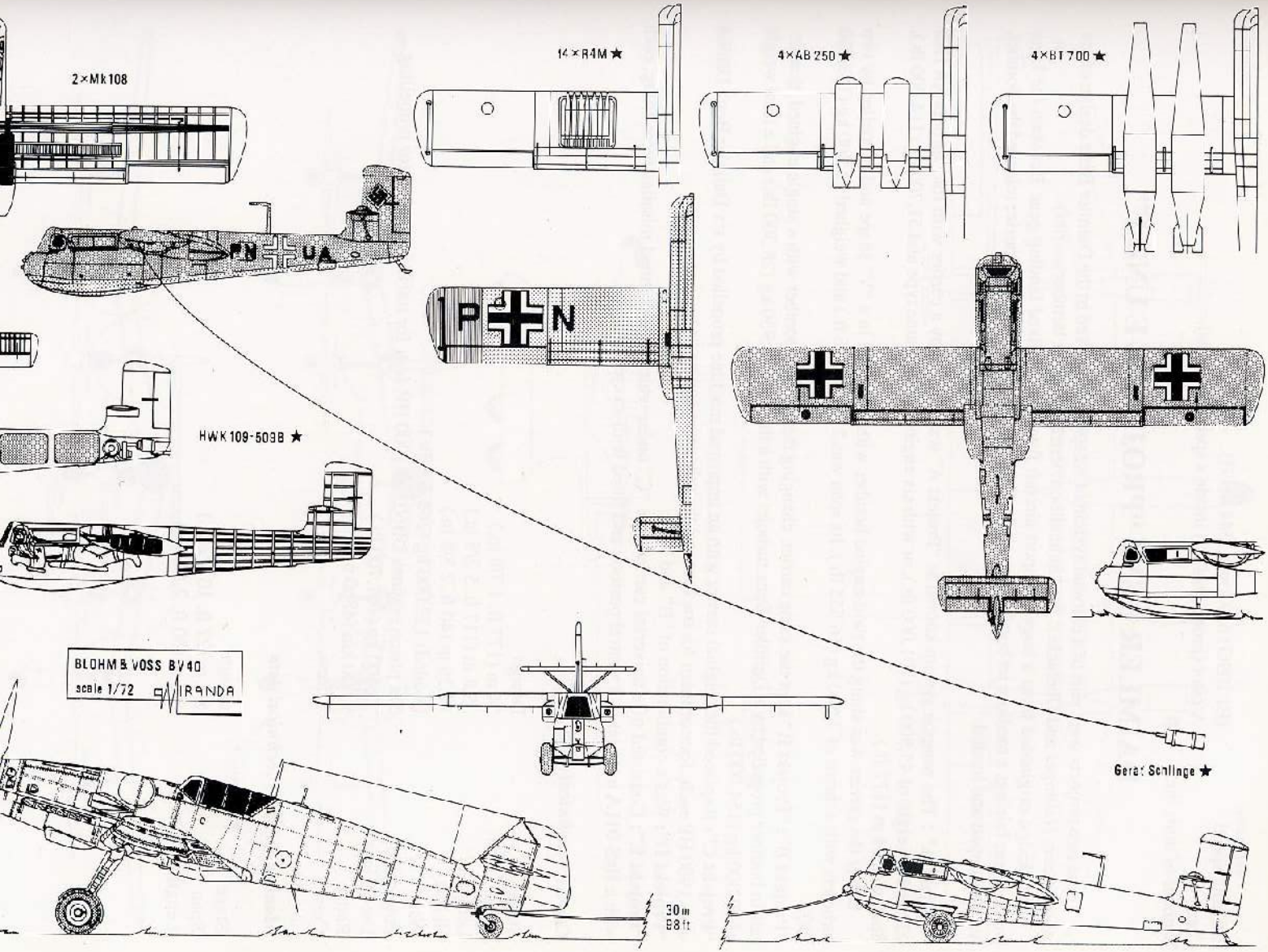
Different modifications were foreseen. It was proposed to use the air to air R4M rockets carried under wings in groups of 7 units. Also, the air to air bombing of "boxes" using four containers of type AB 250 for small charges with proximity fuses. It was also proposed as an anti-ship version fitted with four aerodynamic BT 700 torpedoes. However, the great weight of the plane prohibited the launch from a plane for the last two functions.

The RLM emphasized the BV 40's vulnerability against Allied escort fighters and, trying to save the project, manufacturers proposed motorized variants equipped with two pulsejets Argus As 014 located under the wings, or with a solid propellant rocket HWK 109-509 B, but could not compete with the Me 328 and Me 163 assigned to the same function. The last proposal to use it as a towed fuel tank failed against project Fieseler Fi 103 SG 5041.

Flight tests were made with prototypes V1, V2, V4, V5, and V6 in Wenzerdorf, towed by a Messerschmitt Bf 110.

BV40 (Technical data)

Type	Glider fighter
Stage	Flight tests
Wings	Wood structure and coating with flaps
Fuselage	Wood structure and coating. Armored steel plate of 20 mm (nose), 8 mm (back), and 5 mm (belly) screwed together from the outside. Armored windshield of 120 mm
Tail unit	Wood structure and coating. Brace elevator
Undercarriage	retractable skid
Powerplant	None in the originally projected BV 40A
Weapons	Two guns Mk 108 of 30 mm, or an Mk 108 and a towed mine
Wingspan	7.90 m (25 ft. 11 in.)
Length	5.70 m (18 ft. 8 2/5 in.)
Height	1.63 m (5 ft. 4 1/8 in.)
Launch weight	950 kg (2,097 lb.)
Diving maximum speed	1,037 km/h (560 MPH)


2×Mk108
14×R4M★
4×AB 250★
4×BT 700★
HWK 109-509B ★
BLOHM & VOSS BV40
scale 1/72
IRANDA
Gerät Schlinge ★
30 m
98 ft

Cruising speed	(Bf 109G) 637 km/h (344 MPH)
Crew	A pilot (prone position inside a special harness).
Number of units built	6

DAIMLER BENZ "PROJEKTE E UND F"

These two projects were part of a colossal system of weapons conceived in the Daimler Benz design office by engineers Nallinger and Übelacker: the "Schnellbomberträger" (Fast bomber carrier).

The design originated from a huge transport aircraft fitted with a fixed landing gear. Between the large landing gear fairings a medium jet bomber was slung. When close to the target, the carrier released the bomber, fully equipped and loaded.

"Projekt A" : The weapon system known as "Projekt A" was formed by a carrier with four turboprops HeS 021 and a weight of 45,800 kg (101,000 lb.), or with six engines of the same type and 51,700 kg (114,000 lb.). Span was 54 m (177 ft.).

Under the carrier was slung the twin-engine bomber with a tail unit in a "V" shape and propelled by two turbojets with a thrust of 7,500 kg (16.555 lb.). Its span was 23.16 m (76 ft.) and weighed 71,800 kg (158.290 lb.).

"Projekt B": "Projekt B" kept the same carrier, changing the parasite bomber with a single engined, double-tailfin bomber propelled by a Daimler-Benz turbojet with a thrust of 12,930 kg (28.500 lb.) and a total weight of 70,000 kg (154.000 lb.).

"Projekt C": Replaced the original carrier with an improved machine propelled by six Daimler Benz DB603 with 1900 HP each, four of them for traction and the other two for pusher.

"Projekt D": Was a combination of "B" and "C".

"Projekt E": Consisted of a universal carrier type "C" under which five manned missiles were slung, each with a HeS 011A turbojet in a ventral position and fitted with an ejector seat.

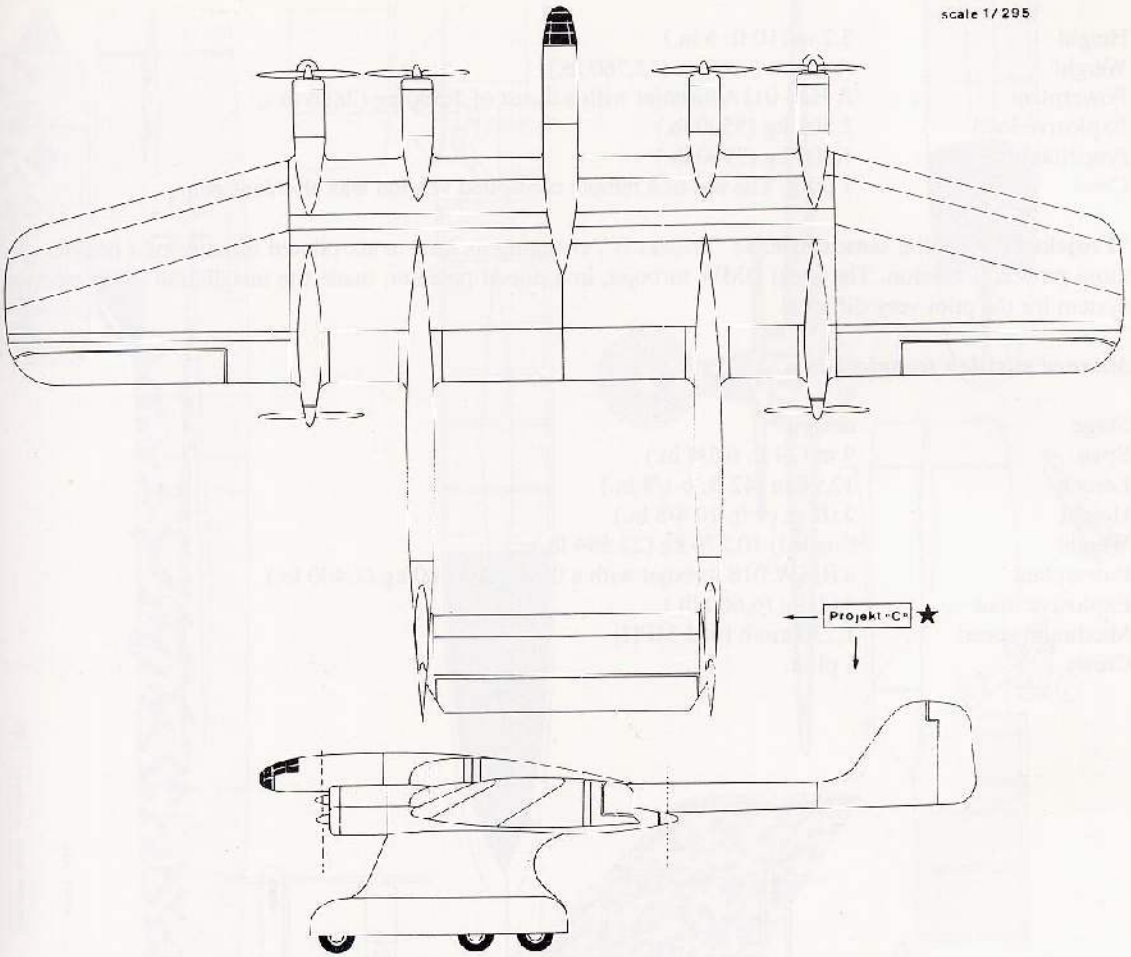
Carrier's technical data

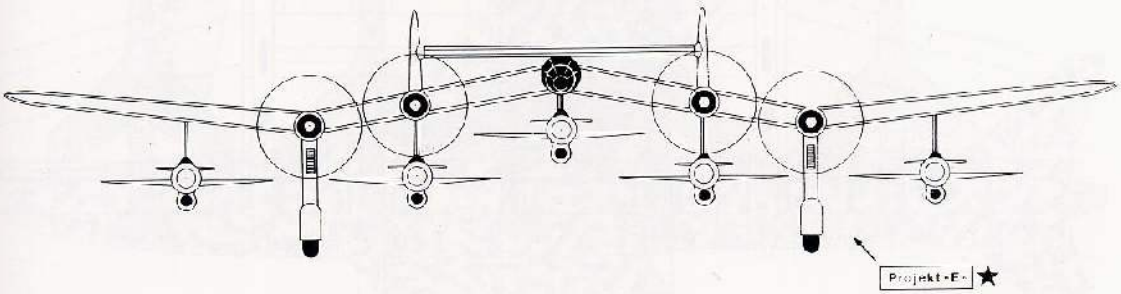
Stage	Design
Span	54 m (177 ft. 1 7/8 in.)
Length	35.8 m (117 ft. 5 2/5 in.)
Height	12.26 m (40 ft. 2 5/8 in.)
Weight	(loaded) 122,000 kg (268.400 lb.)
Powerplant	Six piston engines DB603 of 1900 HP, four for traction and two for propelling
Useful load	73.500 kg (161.700 lb.)
Range	9,000 km (4860 mi.)
Crew	4 crew.

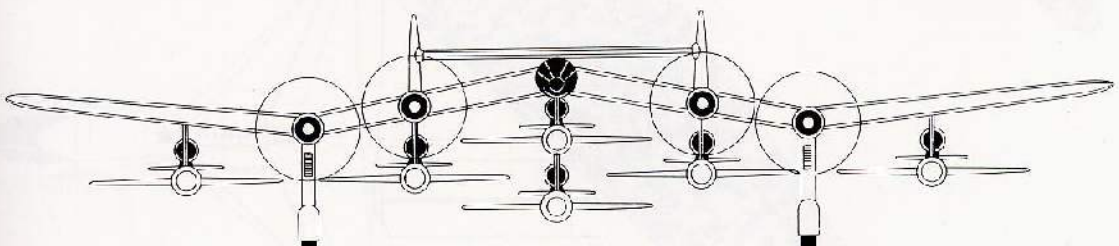
Manned missile's technical data

Stage	design
Span	8.5 m (27 ft. 10 1/2 in.)
Length	9.2 m (30 ft. 2 1/8 in.)

scale 1/295





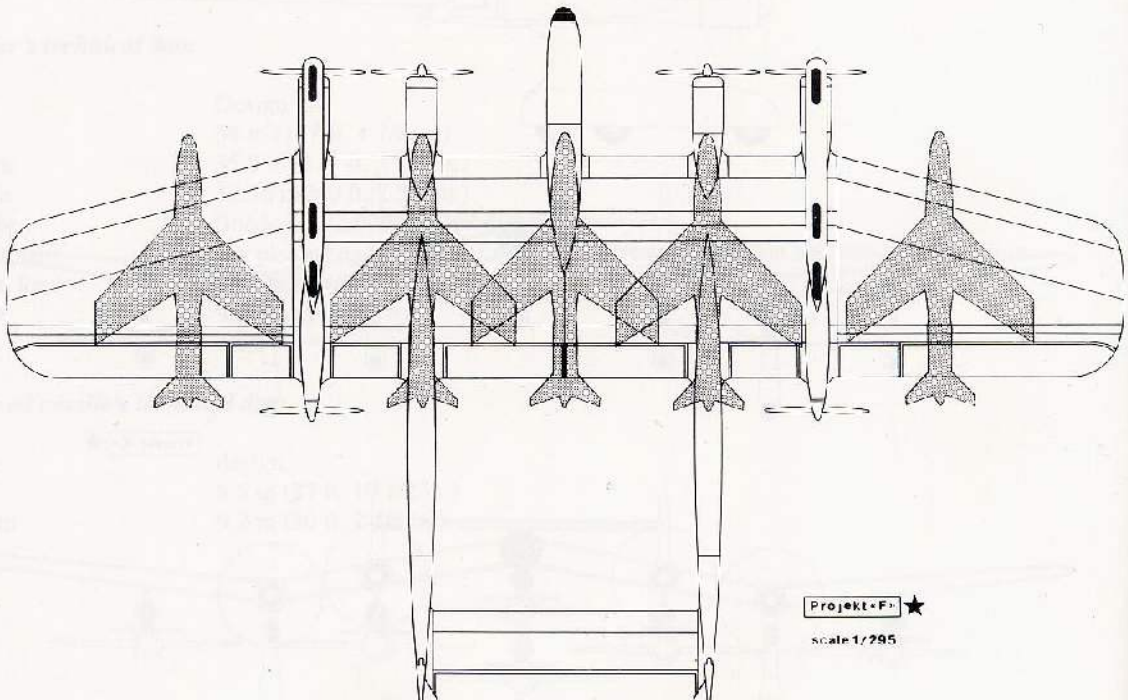


Height	3.2 m (10 ft. 6 in.)
Weight	(loaded) 5,800 m (12,760 lb.)
Powerplant	A HeS 011A turbojet with a thrust of 1.300 kg (2886 lb.).
Explosive load	2,500 kg (5500 lb.)
Propellant load	1,800 kg (3960 lb.)
Crew	1 pilot. The use of a remote controlled version was also foreseen.

"Projekt F" Kept the same carrier as "Projekt E", changing its load to six piloted missiles of a heavier and more powerful version. The great BMW turbojet, in a dorsal position, made the installation of an ejection system for the pilot very difficult.

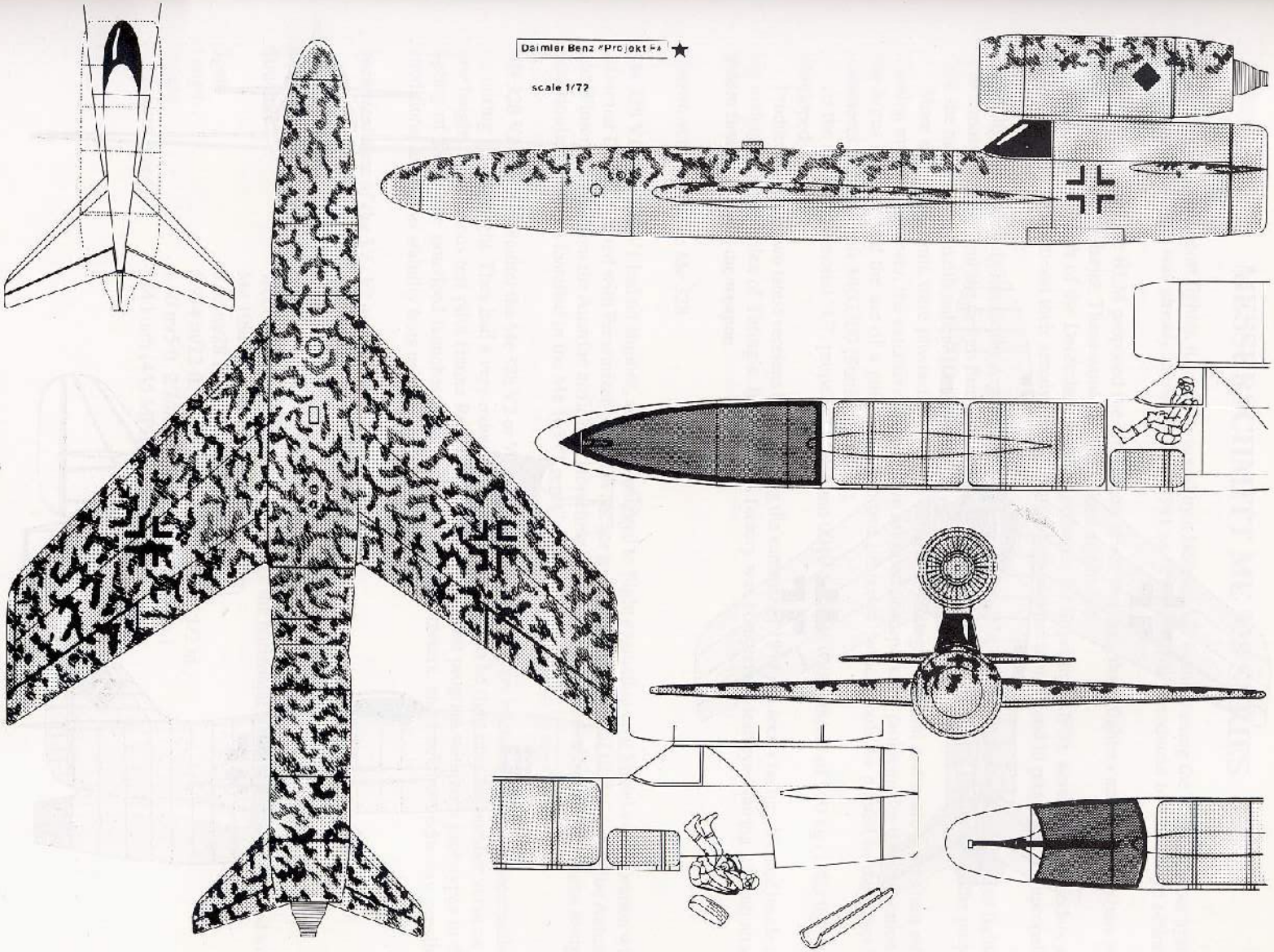
Manned missile's technical data

Stage	design
Span	9 m (29 ft. 6 3/4 in.)
Length	12.96 m (42 ft. 6 1/8 in.)
Height	3.02 m (9 ft. 10 4/5 in.)
Weight	(loaded) 10,270 kg (22,594 lb.)
Powerplant	a BMW 018 turbojet with a thrust of 3,400 kg (7,400 lb.)
Explosive load	3.00 kg (6,600 lb.)
Maximum speed	1,230 km/h (665 MPH)
Crew	1 pilot.



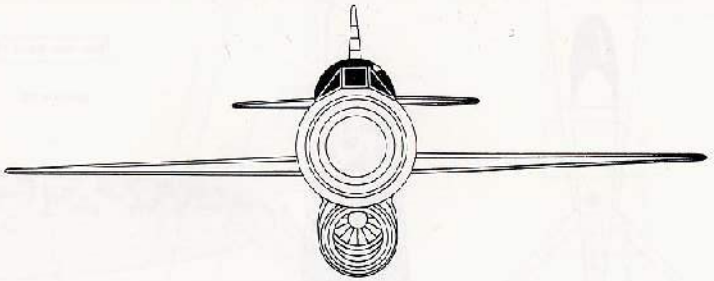
Daimler Benz "Projekt 4" ★

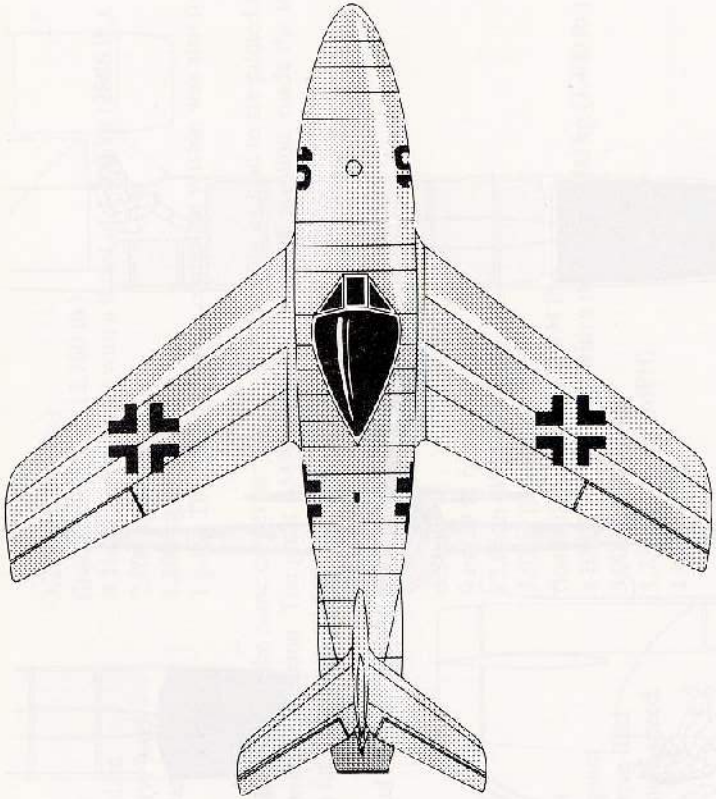
scale 1/72

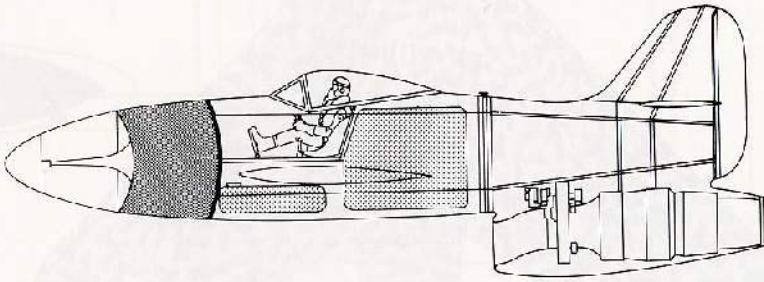


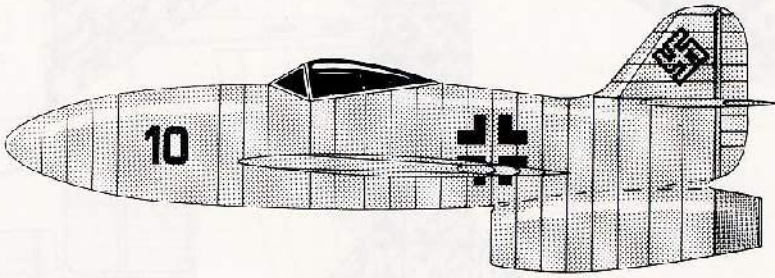
Daimler Benz «Projekt E» ★

scale 1/72









MESSERSCHMITT ME 328 SERIES

Designed as an escort fighter, it could be towed by a Heinkel 177 bomber using the semi-rigid bar system "Deichselschlepp". It was already known in July 1941 as "Projekt 1079", produced by the design office of Messerschmitt.

In March 1942 the RLM proposed the production of six versions, three fighters and three bombers propelled by an Argus pulsejet. These would be designated as Me-328.

Under the direction of the Deutsches Forschungsinstitut für Segelflug (DFS), several scale models and prototypes were built to test their aerodynamic features, both in wind tunnels and in propelled or unpropelled flights.

In flight thrust regulation for the Argus engines proved impossible, and the foreseen production of fighters was almost canceled, but the design firm had a great influence on the RLM and they finally saved the project with the name of "Schnellbomber" (fast bomber) in April 1944.

More than 1000 units were planned to be made using non-strategic material and spare parts from other existing models. However, the extensive test program revealed unsurpassable problems for the integration of the Argus engines, and the use of a gliding version was proposed which could be piloted to the target by volunteers from the unit 5/KG200 (Staffel Leonidas).

At the same time, model "C", propelled by a Jumo 004B turbojet with a thrust of 900 kg (1980 lb.), was developed.

Production of the two latest versions began during the summer of 1944 in a secret factory located inside the big underground complex of Turingia. It seems this factory was completely destroyed during a bomb attack before first delivery of the weapon.

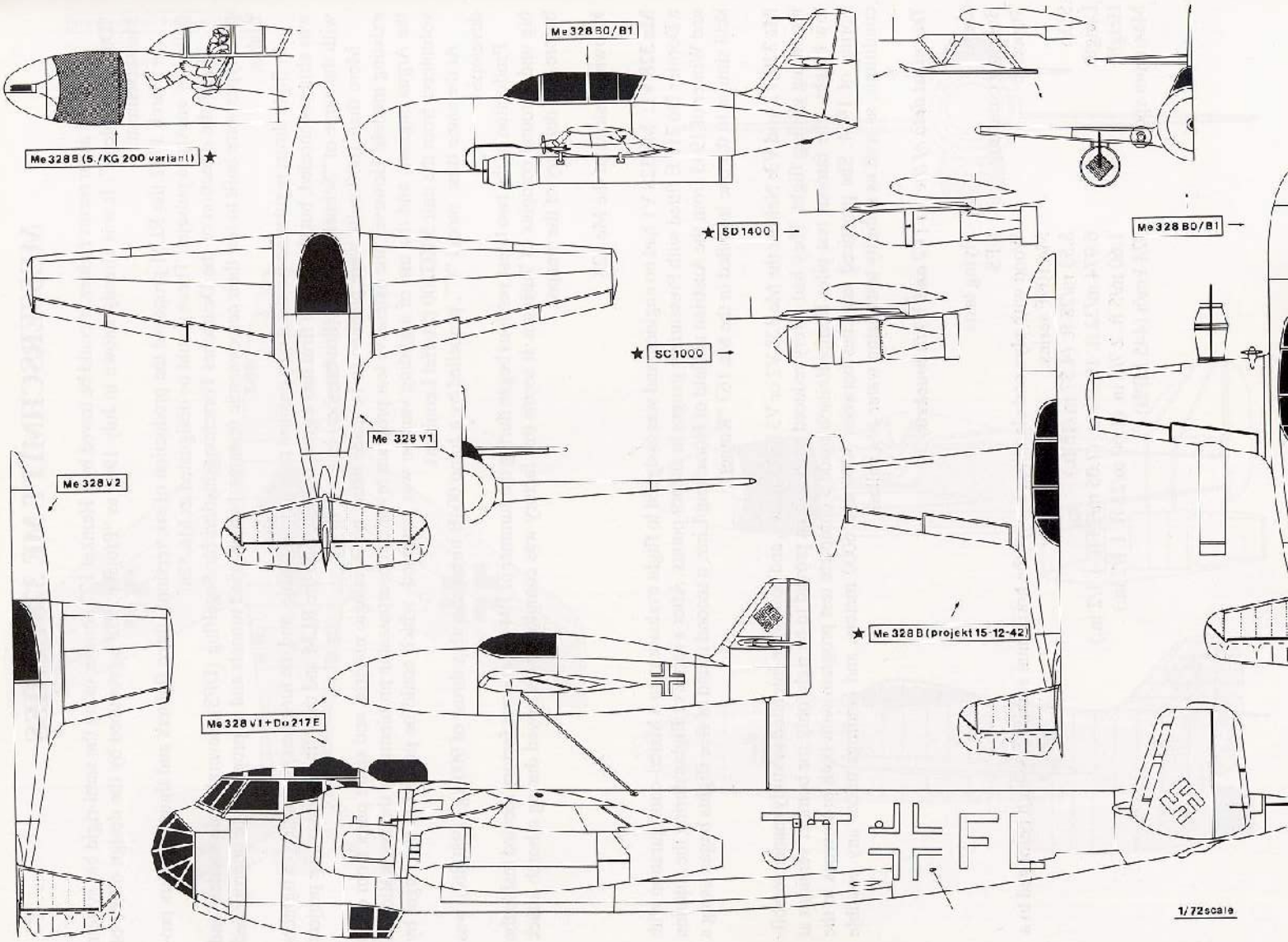
Known versions of the Me 328

Me 328 V1: Me 328 V1 had no engines, and was assigned to flight evaluation on a Mistel-configuration with a Dornier Do 217 E fitted with Pressurizer gauges in anchor points. After a series of flights during the Autumn and Winter of 1943 from the Austrian airfield of Hörsching/Linz, a second round of free flights began using a skid similar to the one installed in the Me 163 "Komet".

Me 328 V2 and V3: Neither the Me 328 V2 or V3 had engines, and both were intended to study maneuverability during gliding flight. They had a very reduced span, which proved to be right only for bomber versions at low height. The famous test pilot Hanna Reitsch made a complete test program with both prototypes in the Spring of 1944. She practiced launches between 3000 and 6000 meters, and landings under any possible conditions, as well as stability tests using water as a ballast.

Technical data of the V1 (V2 and V3 in brackets)

Stage	Flying tests
Building company	DFS
Structure	Wood with plywood cladding, except the horizontal stabilizer which belonged to a Me 109F series.
Span	8.53 m/28 ft. (4.57 m /15 ft.)
Length	6.974 m/22 ft. 10 3/8 in. (7.05 m/23 ft. 1 1/2 in.)
Height	1.60 m/5 ft. 2 7/8 in. (1.60 m/23 ft. 1 1/2 in.)
Maximum speed	824 km/h (445 MPH)


Me 328 B0/B1
Me 328 B (5./KG 200 variant) ★
★ SD 1400
Me 328 B0/B1
★ SC 1000
Me 328 V1
Me 328 V2
★ Me 328 B (projekt 15-12-42)
Me 328 V1+Do 217 E
1/72scale

Me 328(V4-V10): Seven more prototypes (V4 to V10) were built by the firm Jacob Schweyer Segelflugzeugbau for static and flying evaluation purposes.

A number of them were destroyed due to vibrations produced by the shock waves of the Argus engine on the tail unit and rear fuselage structures. This caused them to be positioned under the wings and into shock-absorbing holders fitted with explosive bolts for a quick release. Anyway, subsequent tests showed that it was very difficult to synchronize both things working together, and that different phase in thrust produced uncontrollable vibrations in the structure. Several Argus were launched when in emergency situations. The program of propelled flights was canceled in the middle of 1944.

Foreseen versions of Me 328

Fighter versions (Me 328 A-1)

Stage	Project
Span	6.4 m (21 ft.)
Length	6.8 m (22 ft. 5 in.)
Height	1.6 m (5 ft. 2 7/8 in.)
Powerplant	2 Argus As 014 pulsejets with a thrust of 300 kg (660 lb.)
Weight launch	2,185 kg (4,807 lb.)
Armament Two	20 mm. MG 151 guns
Maximum speed	750 km/h (405 MPH)
Range (after launch)	700 km (378 NM)

Me 328 A-2

Stage	Project
Span	8.5 m (27 ft. 10 3/4 in.)
Length	6.8 m (28 ft. 3 3/4 in.)
Height	1.6 m (5 ft. 2 7/8 in.)
Lifting surface	1.6 m (129, 16 sq. ft.)
Powerplant	four Argus As 014 with a thrust of 300 kg (660 lb.) each
Launch weight	3,790 kg (8,355 lb.)
Armament	Two 20 mm Mg 151 and two 30 mm Mk 103 guns.
Maximum speed	920 km/h (572 MPH)

Me 328 A-3 Version very similar to the A-2 but fitted with refueling probe.
All these had two fuel tanks behind the cockpit with a total capacity of 1,000 lbs. (264 Us gal).

Bomber versions (Me 328 B-0/B-1)

Very similar to the A-1, it had two additional fuel tanks in the nose with a capacity of 500 lbs. (132 U.S. gal.) each, and a bomb of 500 kg (1100 lb.) suspended under the landing skid.

Stage	Flying tests
Maximum speed	680 km/h (367 MPH)
Range (after launch)	600 km/h (324 NM)
Launch weight	2,695 kg (5941 lb.)

Me 328 B-2

Like the A-2, but equipped with two additional fuel tanks with a capacity of 500 lbs. (132 U.S. gal.) each in the nose, and a bomb of 1,000 kg (2200 lb.) suspended under the landing skid.

Stage Project.

Me 328 B-3

Similar to the A-2, but with less fuel capacity and able to carry a 1,400 kg (3,080 lb.) bomb under the fuselage.

Stage Project.

Me 328 C

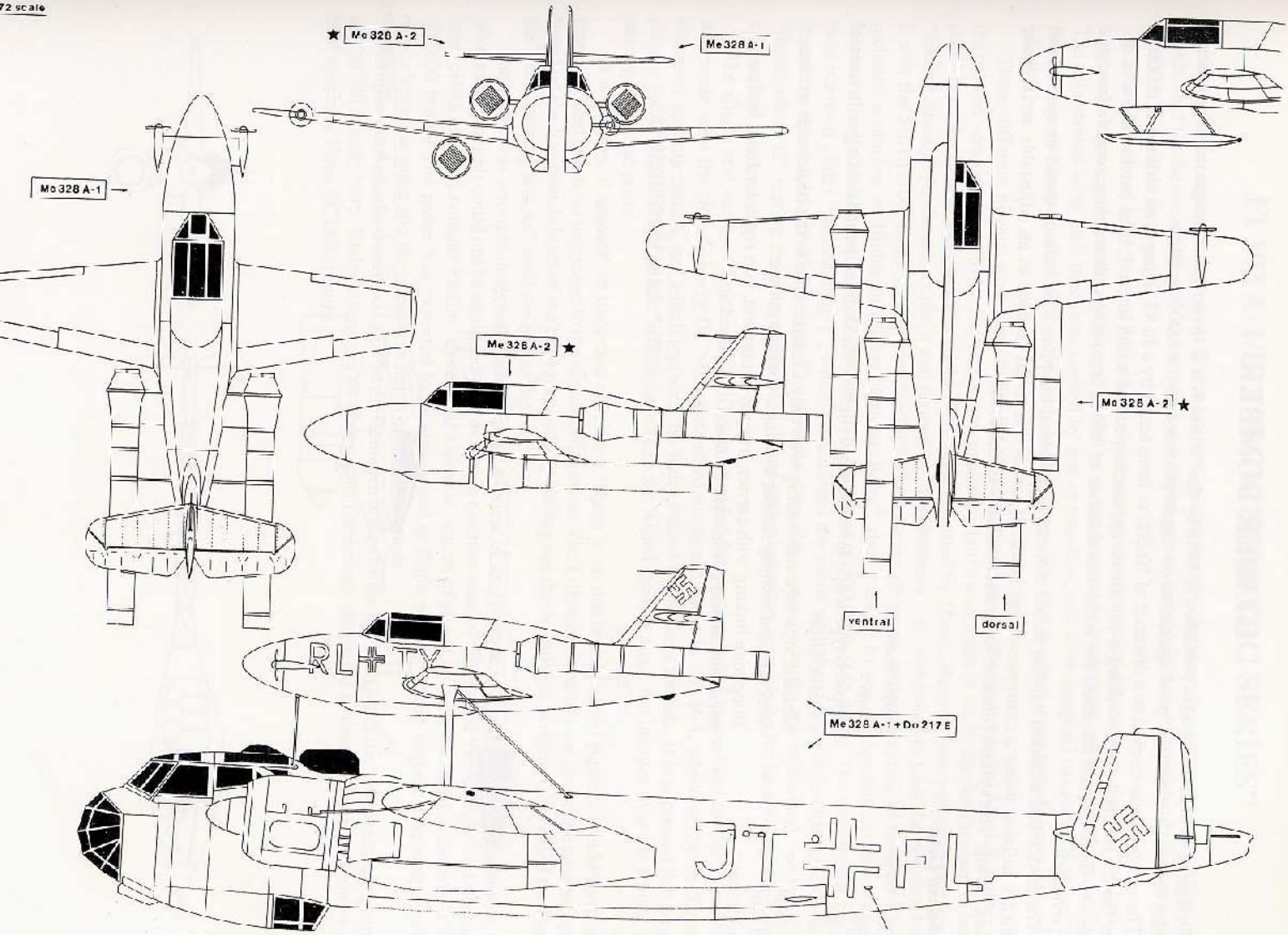
Propelled variation based on the B-2 and fitted with a Jumo 004B turbojet. The attack version, intended for the 5.KG/200, was a design based on a B-1 without engines and to be carried in a Mistel configuration by a Me 264 or a He 177.
The rear fuselage was designed to be released from the aircraft by means of explosive bolts so the pilot could easily eject.

Stage Project.

A project for a folding version existed, to be launched from a submarine's catapult fitted with a 500 kg warhead in the nose and two Argus As 014 under the wings.

Apart from the towed versions, some studies for launching it from land were made using either a Lippisch launching trolley with three wheels, propelled by accelerator rockets, or a Rheinmetall-Borsig with a launching rail, which was also accelerated by rockets.

72 scale


★ Me 328 A-2
Me 328 A-1
Me 328 A-1
Me 328 A-2 ★
Me 328 A-2 ★
ventral
dorsal
Me 328 A-1 + Do 217 E

GLIDER BOMBER

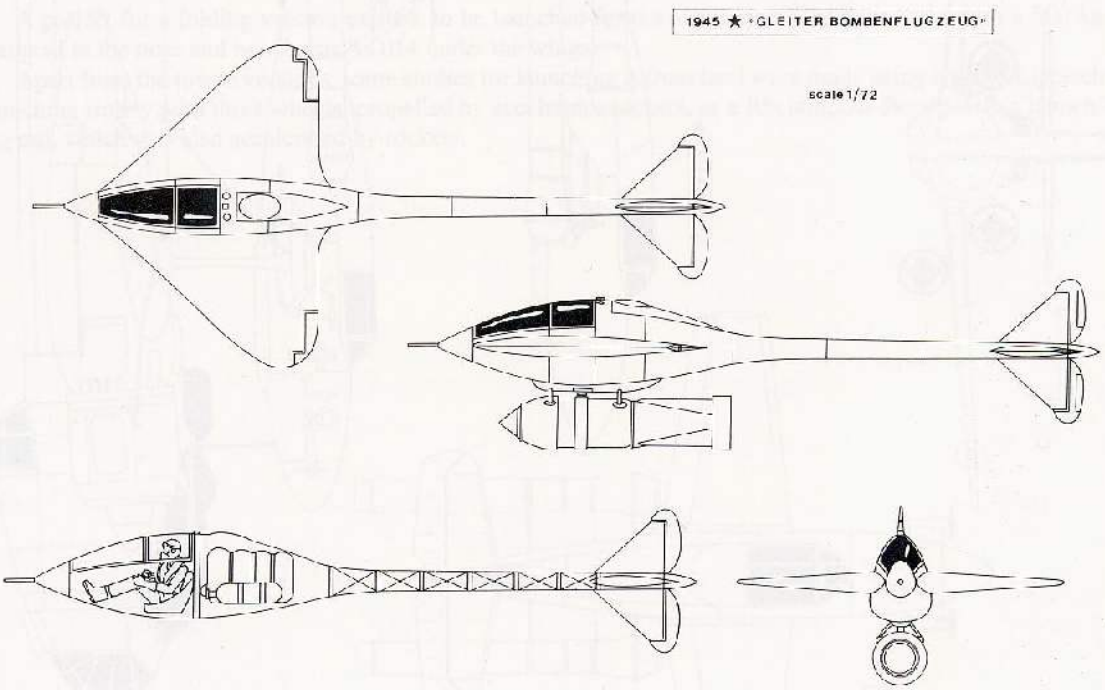
Design of an unknown origin published in 1988 by the "World War II Investigator" magazine. It represents a glider able to dive at high speed against naval targets provided with a 1,000 kg bomb.

The machine was carried to a distance of 10,000 m from target by a Ju 88 flying at an altitude of 8,000 m After launch it dived until reaching a calculated approach speed of 1,296 km/h. It then entered the area defended by the DCA and launched the bomb at a distance of 700 m from target, then flying away following a soft, rising curve.

The device had a folded balloon inside a dorsal tank behind the pilot. This balloon could be ejected and gradually inflated using a compressed gas bottle. It seems this could be used as an adjustable aerial brake during diving. The system foreseen to recover the pilot is unknown.

Technical Data

Type	Glider bomber
Stage	project
Wings	Lippisch type shape for high speed flights. Wood structure and coating with internal metallic struts
Fuselage	Metallic structure and coating with only a tubular spar in the backwards section
Tail unit	Structure and coating similar to wings. Cruciform type.
Equipment	Telephone linking with carrier, oxygen equipment, gun sight, artificial horizon, anemometer and gyroscopic compass.



FI 103 A-1/B-1 "REICHENBERG SERIES"

The poor accuracy displayed by first models of guided bombs, the alarming advance of the Allies on all fronts, and the failure of the submarine offensive drove some German leaders to consider desperate combat methods to balance the war.

In the middle of 1944, several fantastic designs were proposed: rocket-interceptors, fast jet bombers, and long range missile submarines. At the end of that year, the proposed interceptors were of the "Rammer" type. The submarines were little machines crewed by one or two men, and were assigned to coastal defense. They fired one or two torpedoes as near as possible to the enemy. The fast bombers were transformed into piloted bombs.

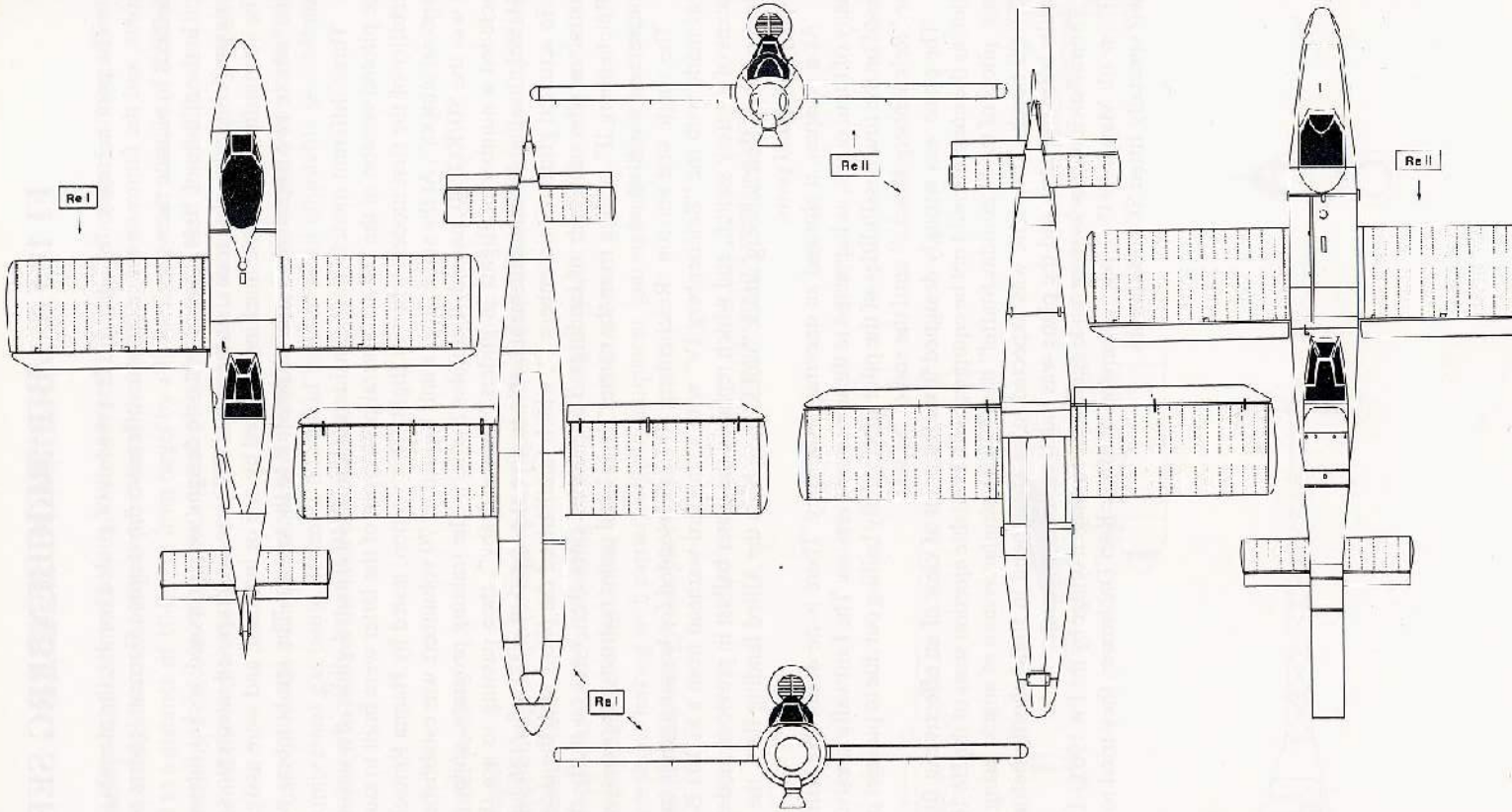
Three different models were considered: the BV40 armored glider, the unsuccessful Me 328 fighter, and the piloted version of the "V-1". Several prototypes of the latter were built to study the deficiencies in lateral stability of the first models when in flight. This version, tested by Hanna Reitsch, was proposed to carry out "special attacks". At the same time, a unit formed by 70 volunteers was established to pilot the new machines. It was the 5II/KG200, named "Leonidas Staffel". The training program, under direction of General Korten, included a number of flights in gliders "Grunau-Baby", then passing to use the special cut down winged "Habicht" called "Stummelhabicht", able to dive at a speed of 300 km/h (186 mph). The next model was the twin actuated glider "Reichenberg I", which familiarized the pilots with the short wings, although it was the instructor who took care of landings. The selected ones then went on to fly the motorized version of the "Reichenberg II", testing from the carrier Hc 111 and under instructor supervision for launch sequence, flight course, and mock attack.

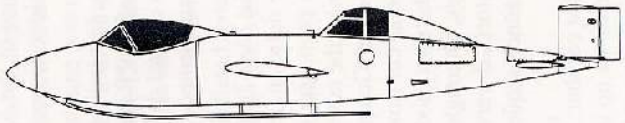
The single seat version "Reichenberg III" was intended for keeping pilots trained for combat. Last flight was made with the "Reichenberg IV" with a standard warhead from a Fi 103 B-1, which set up in flight by means of a safety switch, and which replaced the water ballast in previous models. It is supposed that targets chosen for a "Reichenberg attack" would have been the Allied landing fleet, the bridges over the Rhine, and enemy command posts.

As a weapon, it showed an uncertain efficiency. There is no doubt that Allied fighters would have shot many of them down, as happened to the unmanned version. The Luftwaffe's resistance to use the new weapon, based on the low possibilities of the pilot successfully bailing out due to pulsejet position, prevented the use of the "Reichenberg attacks" until the end of the war.

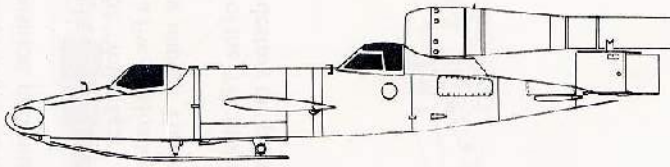
The plane was wrongly designed from the point of view of an effective in flight escape capability for the pilot, as the cockpit could not be equipped with available ejection seats of the He 162 "Volksjäger". At the same time, pilots of the "Leonidas Staffel" developed a similar system of attack, using a Fw 109 loaded with a SB/SC1000 bomb. The plane was expected to be abandoned in flight shortly before impact. Theoretically, the results were the same and the plane was much easier to evacuate.

Semi-suicidal attacks were made against the Remagen bridge by the Fw 190 G-1 of the "Nachtschlachtgruppe 20" on 7th March 1945. Under command of Major Kurt Dahlmann, they tried to destroy the pillars throwing their specially fitted SC1800 bombs.





Fi103A-1 · Reichenberg I



Fi103A-1 · Reichenberg I

1/72 scale

Fi 103 A-1/Rel "Reichenberg I" (Technical data)

Type	Training glider
Wings	Metallic structure and coating. Single tubular spar. Ailerons
Fuselage and tail unit	Similar to the Fi-103 A-1, using sand as ballast
Landing gear	Skid with shock absorbers
Equipment	Double controls, anemometer, altimeter, and turn and bank gauge
Wingspan	5.37 m (17 ft. 7 1/2 in.)
Length	7.32 m (24 ft.)
Height	1.2 m (3 ft. 11 1/8 in.)
Launch	Towed by a rope from a Henschel Hs 126
Crew	2
Stage	Operational

Fi 103 A-1/ReII "Reichenberg II" (Technical data)

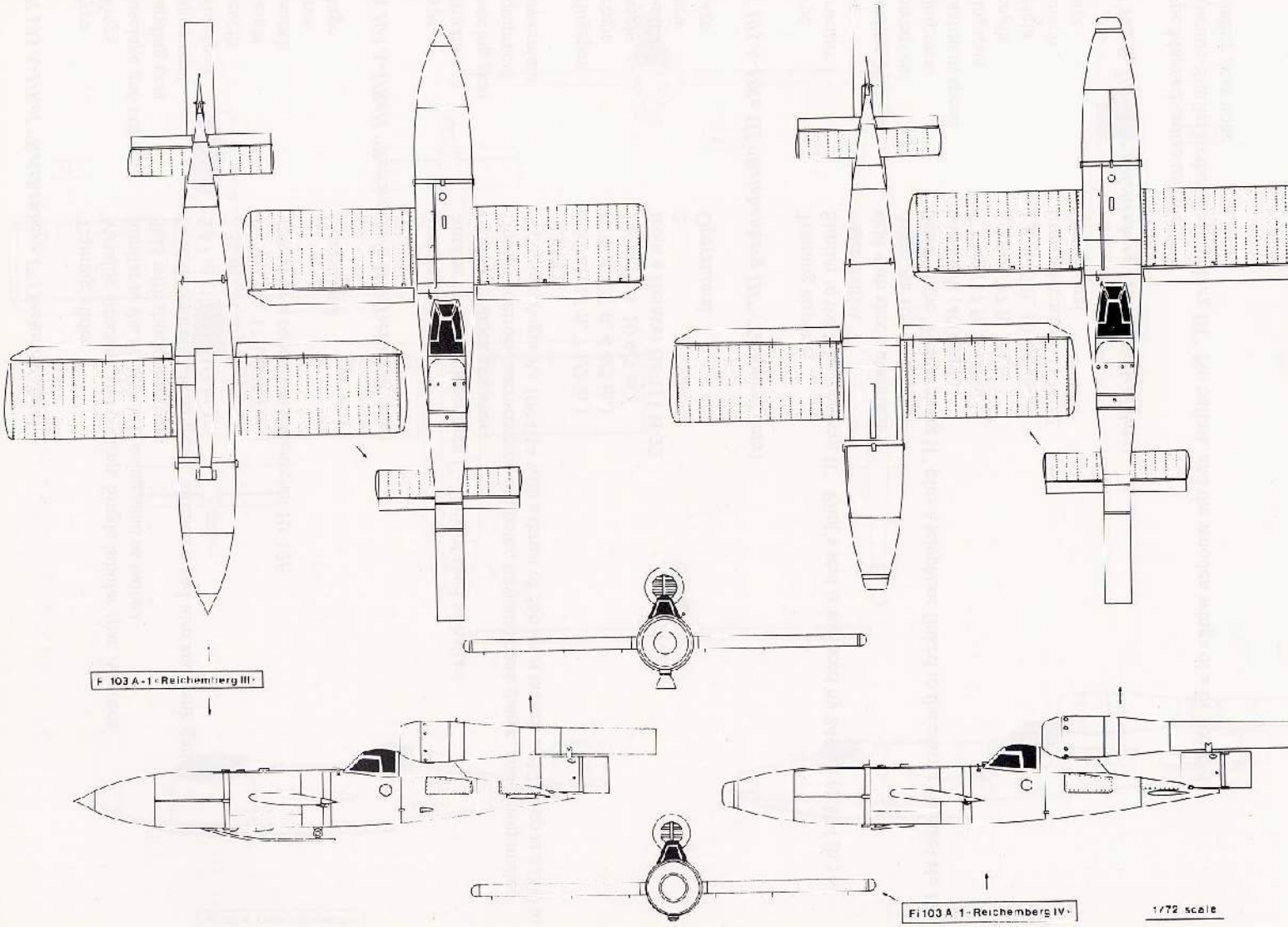
Type	Training aircraft
Structure	Similar to the "Reichenberg I". Tank of sand as ballast
Landing gear	Skid with shock absorbers
Equipment	Double controls, anemometer, altimeter, turn and bank gauge, and chronometer
Powerplant	A pulsejet Argus As 109-014 with a thrust of 366 kp at launch and 254 kp at 3,000 m (9,840 ft.)
Wingspan	5.37 m (17 ft. 7 1/2 in.)
Length	8.35 m (27 ft. 4 4/5 in.)
Height	1.8 m (5 ft. 10 4/5 in.)
Launch	from a Heinkel He 111 H-22
Crew	2
Stage	Operational

Fi 103 A-1/Re III "Reichenberg III" (Technical data)

Type	Training airplane
Structure	Similar to the "Reichenberg II". Pilot's seat is replaced by 849 kg (1,874 lb.) of water ballast
Landing gear	skid with shock absorbers
Powerplant	Argus As 109-014
Equipment	Same as the "Reichenberg II" plus a telephone linked to the carrier Heinkel He 111
Maximum speed	644 km/h (400 mph)
Wingspan	5.37 m (17 ft. 7 1/2 in.)
Length	8.25 m (27 ft. 3/4 in.)
Height	1.8 m (5 ft. 10 4/5 in.)
Launch	from a Heinkel 111 H-22
Stage	Operational

Fi 103 B-1/Re IV "Reichenberg IV" (Technical data)

Type Manned cruise missile
Structure Similar to the "Reichenberg III". No ballast, and the wooden wings of a Fi 103 B-1.
Landing gear none


F 103 A-1 «Reichemberg III»
Fi103 A-1 «Reichemberg IV»
1/72 scale

Warhead	850 kg (1,810 lb.) of Amatol with two impact fuses
Powerplant	Argus As 109-014
Equipment	Same as the "Reichenberg III", plus a gyroscopic compass and a switch to set up the explosive head
Wingspan	5.73 m (18 ft. 9 5/8 in.)
Length	8.2 m (26 ft. 10 4/5 in.)
Height	1.8 m (5 ft. 10 4/5 in.)
Launch weight	2,250 kg (4,960 lb.)
Maximum speed	800 km/h (497 mph) at 2,440 m (8,000 ft.)
Launch	from a Heinkel He 111 H-22 at 2,500 m (8,200 ft.)
Range	330 km (178 NM)
Crew	1
Stage	Flying tests
Number of units built	175

RAMMSCHUSSJÄGER SOMBOLD SO-344

This aircraft was deigned by engineer Heinz G. Sombold of the firm Bley placed in Naumburg/Saale in January 1944.

Originally conceived as a parasite escort plane, the design was altered to obtain a weapon able to break Allied bomber formations over Germany.

A specially converted bomber carried the device to the enemy lines and launched it at a height of 400 m. Then, it began a parabolic approach flight propelled by the Walter rocket to avoid the enemy fighters.

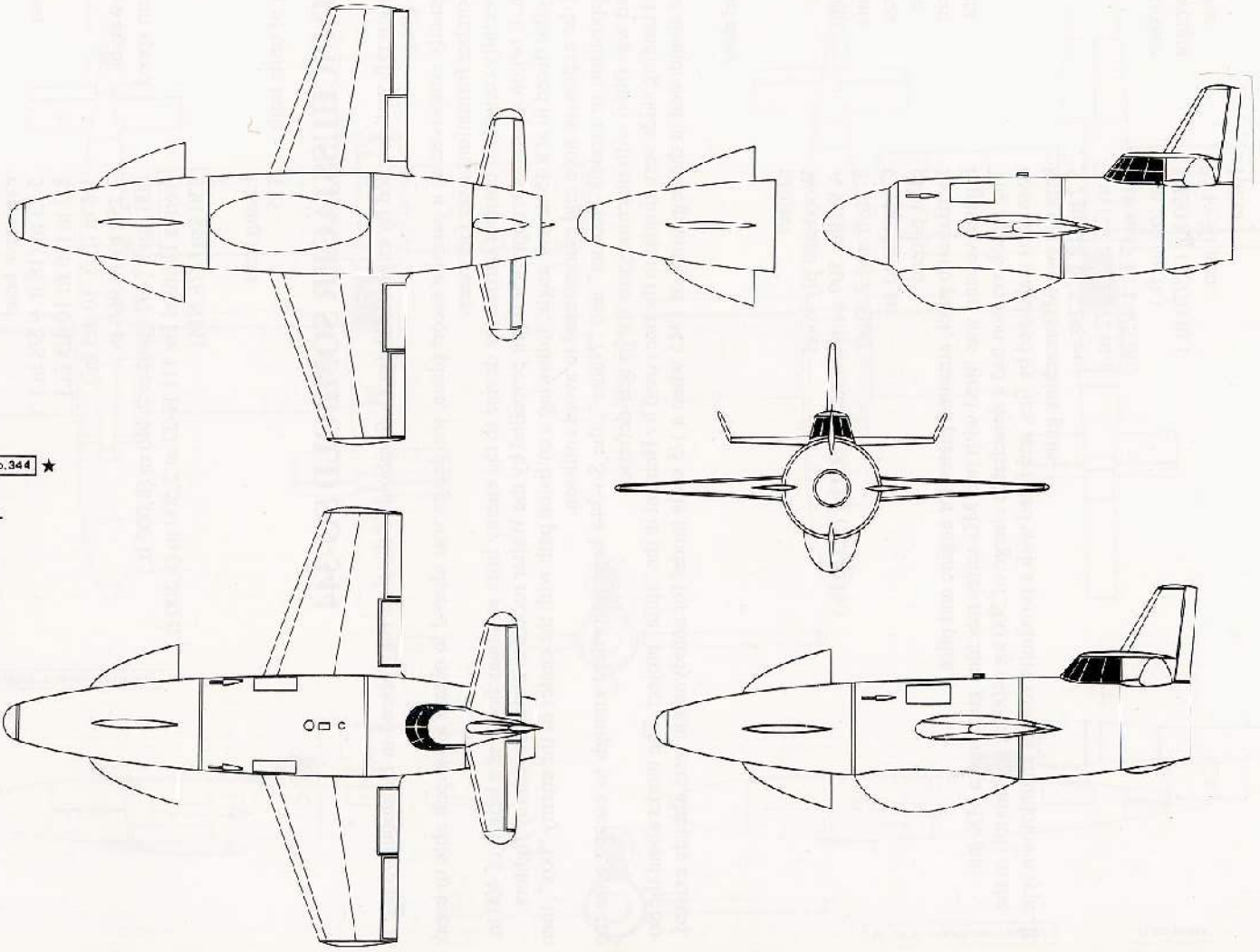
The pilot dived in at a 45 degree angle, following a collision path with the center of the enemy "box", then released the explosive nose and maneuvered to avoid collision.

In opposition to models "Komet" and "Natter", the So-344 kept propellant enough to escape after the attack and was fitted with machine guns for its self-defense.

It had landing skids very similar to the ones used by Heinkel in the "Julia" project. The works about the So-344 were abandoned at the beginning of 1945 when a 1/5 scale model for acrodynamic tests already existed.

Technical data

Stage	project
Structure	Wood and plywood
Powerplant	A Walter 509 with a thrust of 600 kg (1,320 lb.)
Propellants	T-Stoff and Z-Stoff
Pressurizer	Compressed air
Guidance	pilot piloted
Equipment	Inertial auto pilot, armored plates for engine and pilot.
Armament	Fighter version was fitted with two MG series machine guns and a MK gun. The attack version had a detachable charge of 500 kg (400 kg of Amatol) in the nose, was stabilized by fins, and fitted with a proximity fuse of an unknown type. It kept the two MG machine guns.
Span	5.7 m (18 ft. 1 1/2 in.)
Length	7 m (22 ft. 11 1/2 in.)
Height	2.18 m (7 ft. 1 4/5 in.)
Lifting surface	6 m (66 sq. ft.)
Launch weight	1,350 kg (2,970 lb.)
Flying time	25 to 30 min.
Crew	1pilot



Sombold So.344 ★

1/72 scale

ZEPPELIN "RAMMER"

This project for a glider fighter was proposed by the RLM in November 1944. The take-off was to be made using a detachable device similar to the BV 40's, and afterwards moved to the combat area towed by a conventional fighter (probably a Bf 109G).

After being released, the pilot ignited the auxiliary rocket and accelerated to 970 km/h to then launch its bunch of rockets against the "box" of enemy bombers, like a "Natter".

A second attack had been foreseen as in the BV 40, but instead of a towed mine the weapon would be the airplane's own wings built from a high resistance material for ramming purposes, similar to those made by the Fw-190 A-8/R2 of the IV/JG3.

The designer estimated that the wing of a "Rammer" could cleanly cut the tail of a "Flying Fortress" without great loss of speed or stability for the fighter.

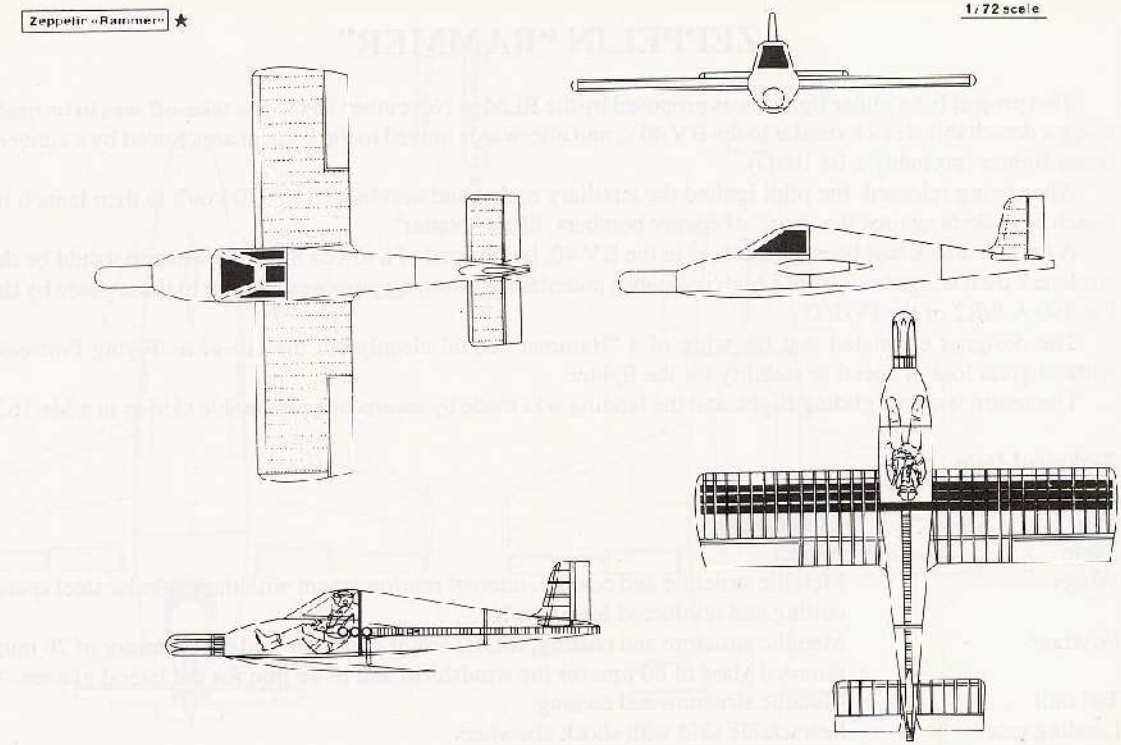
The return was in a gliding flight, and the landing was made by means of a retractable skid as in a Me 163.

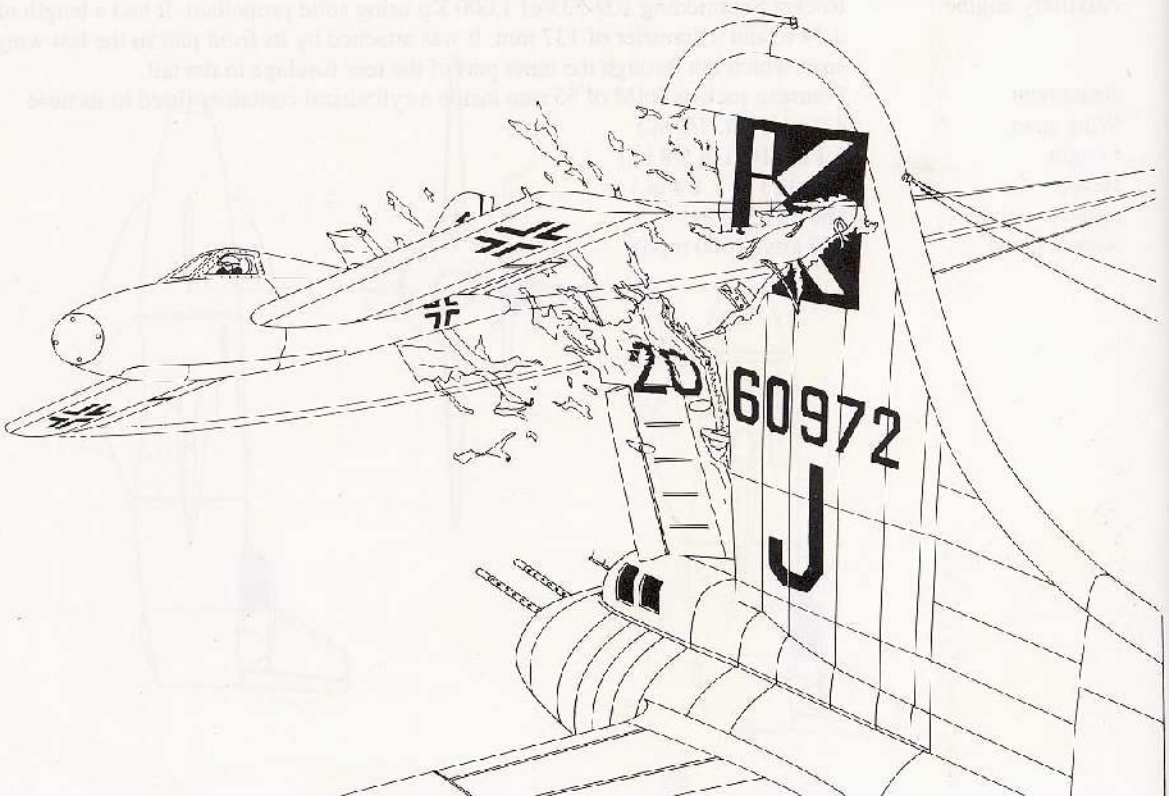
Technical Data

Type	Glider fighter
Stage	project
Wings	Metallic structure and coating, internal reinforcement with three tubular steel spars, cutting and reinforced leading edge.
Fuselage	Metallic structure and coating, frontal armor of 28 mm and dorsal armor of 20 mm, armored glass of 80 mm for the windshield and of 40 mm for the lateral glasses.
Tail unit	Metallic structure and coating.
Landing gear	Retractable skid with shock absorbers
Auxiliary engine	Rocket Schmidding 109-533 of 1,000 Kp using solid propellant. It had a length of 2.74 m and a diameter of 137 mm. It was attached by its front part to the last wing spar, which ran through the inner part of the rear fuselage to the tail.
Armament	Fourteen rockets R4M of 55 mm inside a cylindrical container fitted to its nose
Wing span	4.9 m (16 ft. 7/8 in.)
Length	5.1 m (16 ft. 8 5/8 in.)
Height	1.2 m (3 ft. 1 1/4 in.)
Launch weight	860 kg (390 lb.)
Attack speed	970 km/h (600 mph)

Zeppelin «Rammer» ★

1/72 scale





SPACE FLIGHTS ORIGIN

The film "Frau im Mond", shot in 1938, excited the imagination of many German scientists related with the research of liquid propelled rockets. Those who at the beginning only tried to get a new type of powerful engine suddenly realized that they had on their hands the only instrument able to break the chains of earth gravity, to surpass the sound barrier, and to travel outside the earth's atmosphere.

The idea passed on from the visionary genius type to the scientists, and then to the modest engineers. Fascination for speed and power generated by rockets never left them, and many dreamt of machines landing on the moon's surface.

In July 1969, a group of excited German scientists from the Peenemünde site had the satisfaction of seeing their dream made true with the landing on the moon of the manned Apollo XI, which owed so much to the basic research made by the Germans during the war.

Rocket enthusiasts always worked having in mind space flight, although they had to collaborate with the German Army in the creation and improvement of deadly devices to get the necessary materials and financial support.

Dr. Sänger designed, between 1938 and 1942, a hypersonic glider propelled by rockets and able to go around the world. He extended its range following the method of bouncing it off the upper layer of atmosphere, like a rock impacting water in a flat trajectory.

He proposed its manufacture to the German government as a machine capable of bombing countries on the other side of the planet, and its designation as "Antipodal Bomber". During the 60's, the Americans conceived the hypersonic glider "Dyna Soar" X-20, based on the same principle and a predecessor of the Space Shuttle.

During the worst moments of the war and under intense Pressurizer, the Peenemünde team designed and flew an arrow winged V-2 able to considerably increase its range by means of not ballistic, but gliding flight. There was also a project of a piloted version with a pressurized cockpit and retractable undercarriage. It seems this was presented to the Army as a reconnaissance device.

An even more advanced version, fitted with Gothic delta wings and a rocket motor based in non-cryogenic propellants, was projected as a superior stage of the complex A9/A10. This was an enormous two-stage rocket presented to the OKH (*) as a long range ballistic missile able to reach the cities on the east coast of the U.S. from their launch sites in Europe.

The superior stage, comparable in size and characteristics to the North American X-15, which was built at the end of the 50s, was capable of beyond atmosphere flights.

The designers of all these projects always found a good excuse to introduce a manned version based on poor accuracy obtained by automatic guidance systems.

Theoretically, they were semi-suicidal crews destined to be ejected from the machine in the last moment after leaving it well oriented to the target. In fact, this was the roundabout way to obtain permission and means from politicians to begin manned flights beyond the atmosphere.

(*) See Table 4

BALLISTIC MISSILES

In 1927 the association of rocket researchers, called VfR (Verein für Raumschiffahrt), was founded in Breslau.

Using an Army test site near Berlin named "Raketenflugplatz", they began to test different types of liquid propelled rockets with different success and minimum budgetary resources.

- The "Kegelduese" (conical engine) made a successful flight in July 1930, propelled by petrol and liquid oxygen.

- Different versions of the "Mirak" (Minimumrakete), based on the same principle, were tested in 1930 and 1931 using carbon dioxide as a pressurizer.

- The Hückel-Winkler HW-1 and HW-2 were tested in 1931 and 1932. This time oxygen and liquid methane were used and, for the first time, an electrical ignition system.

- In 1931 several rockets of the Repulsor series, formed by one or two sections which worked with petrol and liquid oxygen, were launched. Water was used as a refrigerant, and a recovery parachute was employed.

A number of these experiments reached heights of up to 1600 meters. In 1932, the VfR contacted some Army officers and made different launches in the test site of Kummersdorf. Due to the limitations imposed on the German artillery by the Treaty of Versailles, the Army followed with great interest the development of these devices which were able to be used as long range artillery.

- In 1932 the HWA "Heereswaffenamt" (Weapons Army Office) created a section dedicated to the study of rockets in Kummersdorf.

- In 1934 VfR's activity stopped and some members, among them Wernher von Braun and Klaus Riedel, went into the HWA as civil engineers under command of captain Walter Dornberger.

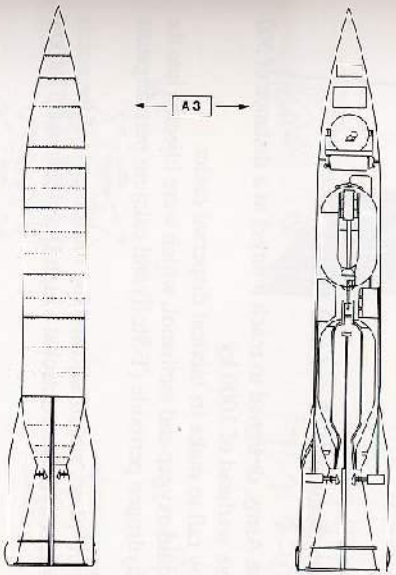
- The first rocket made by the new team, designated A 1 (Aggregate 1) failed during launch because of a defective motor design, which burned liquid oxygen and alcohol. It was stabilized by gyroscopes in the nose.

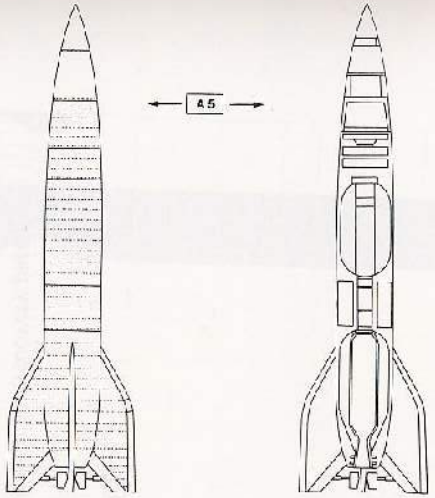
- The A 2 had a gyro-flywheel in its center of gravity and flew successfully up to 2.4 km. high, propelled by alcohol and oxygen, in December 1934.

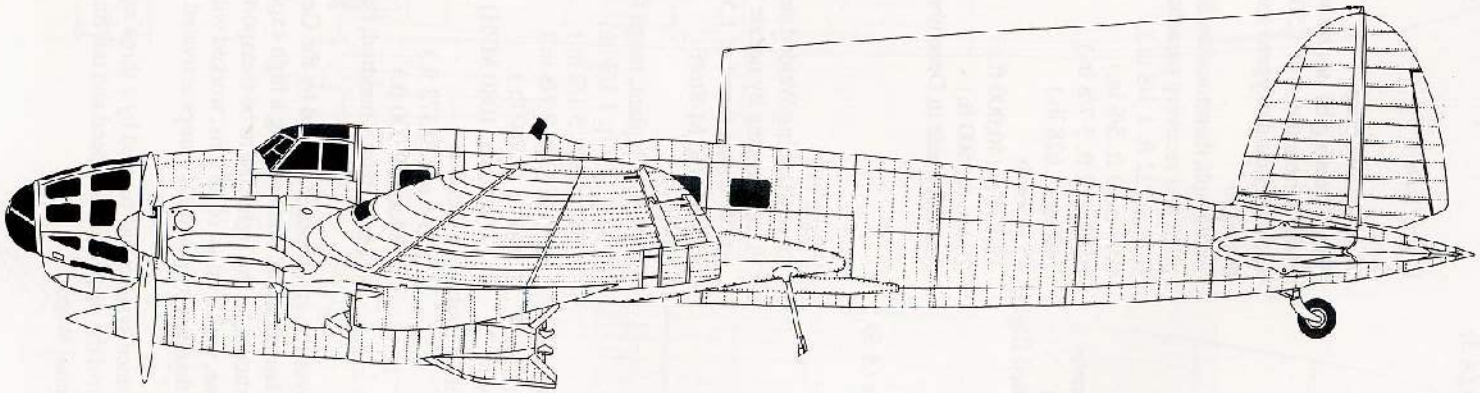
- Model 3 added decisive innovations, and introduced the concept of nozzle vanes to stabilize the rocket at low speed. In 1927, several launches were made in the Greifswalder Oie Isle, and some deficiencies were detected in the gyroscope.

- The Kummersdorf team moved to the Army's new experimental site in Peenemünde, on the Baltic coast, in April 1937.

- The A 5 was designed as an experimental weapon to clear the path for the ambitious A4 project and consisted of a reduced scale version with a simplified guidance system. Tests of every kind were made, including the ones made in the high speed wind tunnel of the HVP, simulated launches from a bomber Heinkel He 111 E, and another thirty real launches made from the Greifswalder Oie site which included parachute recovery. The whole test program resulted as a great success, and heights of 10 km were reached.







A5+He 111E

1/72 scale

Technical Data (A 3)

Stage	Flying tests
Structure	Steel
Cladding	Welded steel plate
Tail unit	Fixed, steering by nozzle vanes
Powerplant	EMW with a thrust of 1,500 kg (3,300 lb.)
Propellants	A-Stoff (liquid oxygen) and M-Stoff (75% ethanol)
Pressurizer	Nitrogen
Equipment	Barograph, thermometer, Shooting camera, dynamic Pressurizer intakes, gyroscopic plant and recovery parachute.
Length	6.74 m (22 ft. 1 3/8 in.)
Span	0.93 m (3 ft. 5/8 in.)
Maximum diameter	0.76 m (2 ft. 5 7/8 in.)
Launch weight	740 kg (1,628 lb.)
Time of propelled flight	45 seconds
Ceiling	12,195 m (40,000 ft.)
Range	20 km (65600 ft.)
Test launches	four, all made in December 1944

Technical data (A 5)

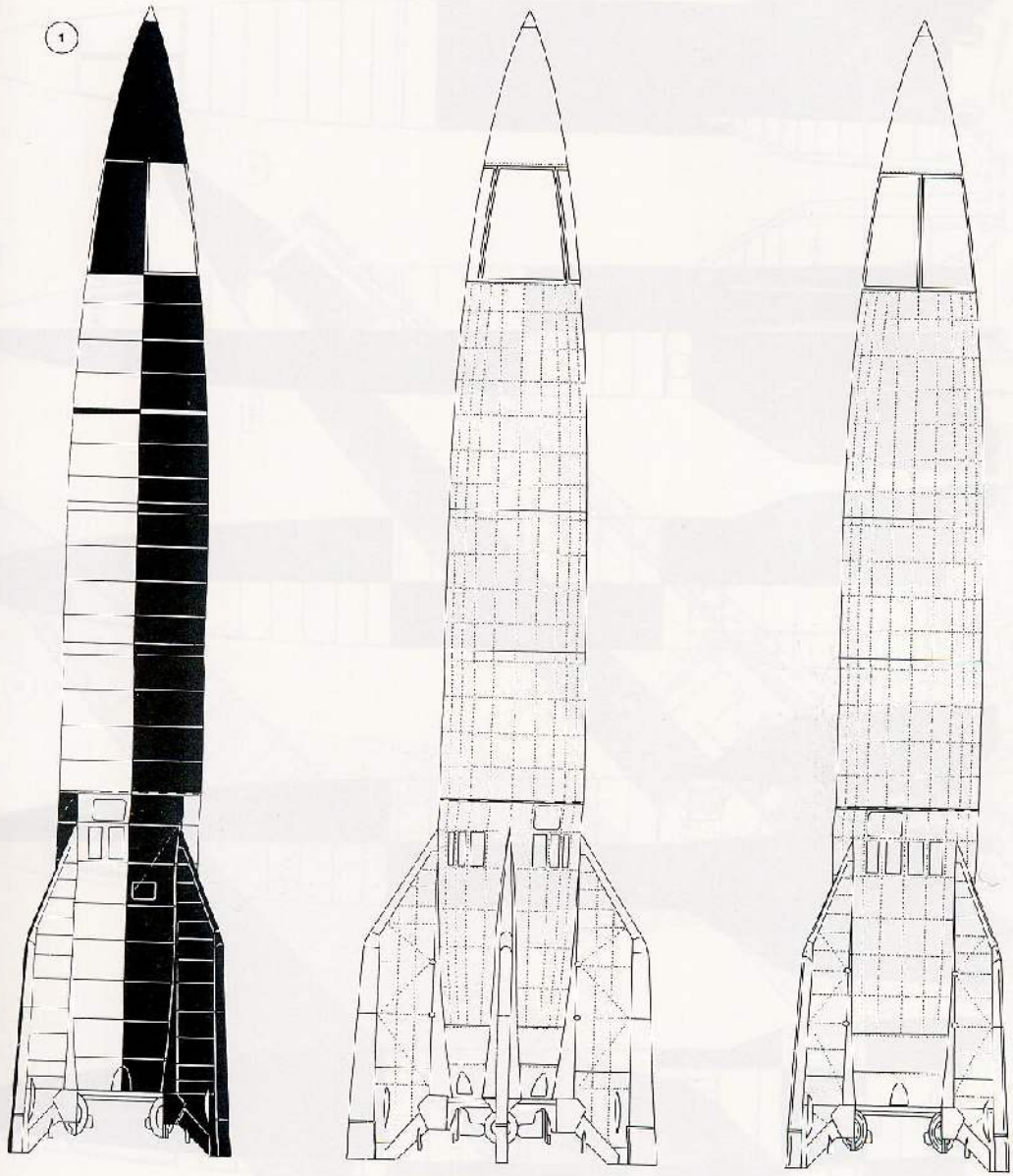
Stage	Flying tests
Structure	Steel Cladding Welded steel plate
Tail unit	Fixed, steering by nozzle vanes
Powerplant	EMW with a thrust of 1,500 kg (3,300 lb.)
Propellants	A-Stoff and M-Stoff
Pressurizer	Nitrogen
Equipment	Gyroscopic plant, range finder equipment and recovery parachute
Length	5.82 m (19 ft. 1 1/8 in.)
Span	2.58 m (8 ft. 5 1/2 in.)
Maximum diameter	0.86 m (2 ft. 9 7/8 in.)
Launch weight	900 kg (1,980 lb.)
Maximum speed	2,000 km/h (1080 MPH)
Time of propelled flight	45 seconds
Ceiling	9,260 m (30,373 ft.)
Range	18 km (59,000 ft.)
Test Flights	More than a hundred, between October 1939 and mid 1942.

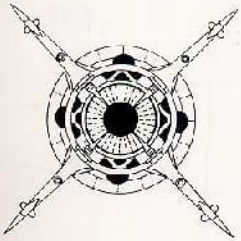
The A 4 was the great rocket desired by the German Army, designed to reach a target at a distance of 300 km from the launch point, and carrying a high explosive warhead of 1000 kg.

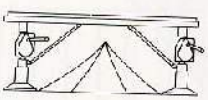
The A 4 should be the right size to be transported by rail to make its tactical dispersal easier.

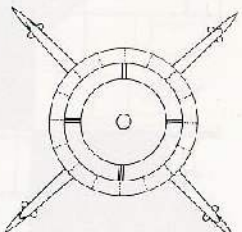
The engine, with a thrust of 25 tons, worked with liquid oxygen and methanol, which were injected into the combustion chamber by powerful pumps activated by hydrogen peroxide (T-Stoff) and calcium permanganate (Z-Stoff).

The guidance system was formed by a three axis gyro-plant, which adjusted the movements of the nozzle vanes to control the device at low speed and tail fins for aerodynamic control at a high speed (even at 5760 km/h in the terminal stage).

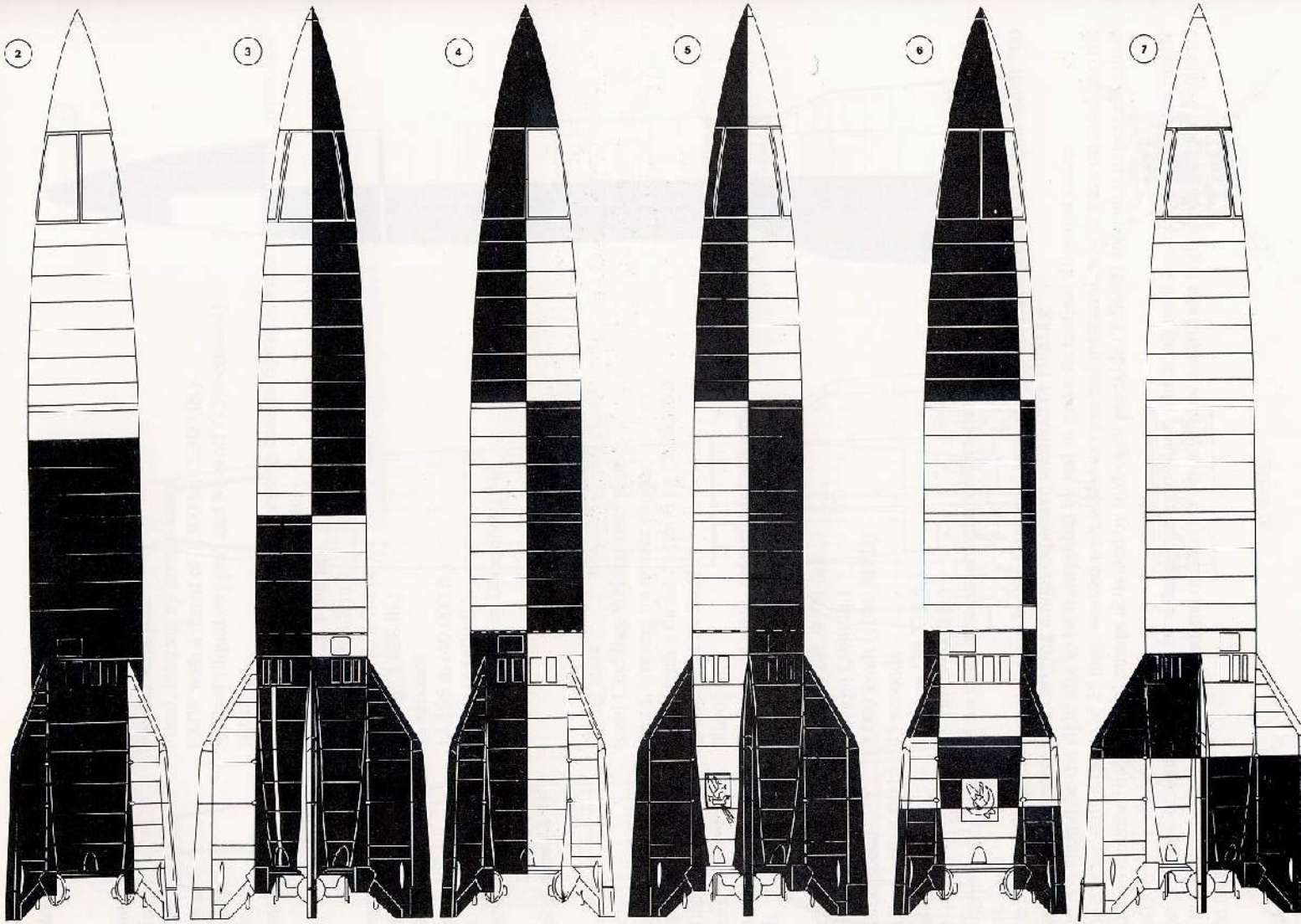








Scale 1/72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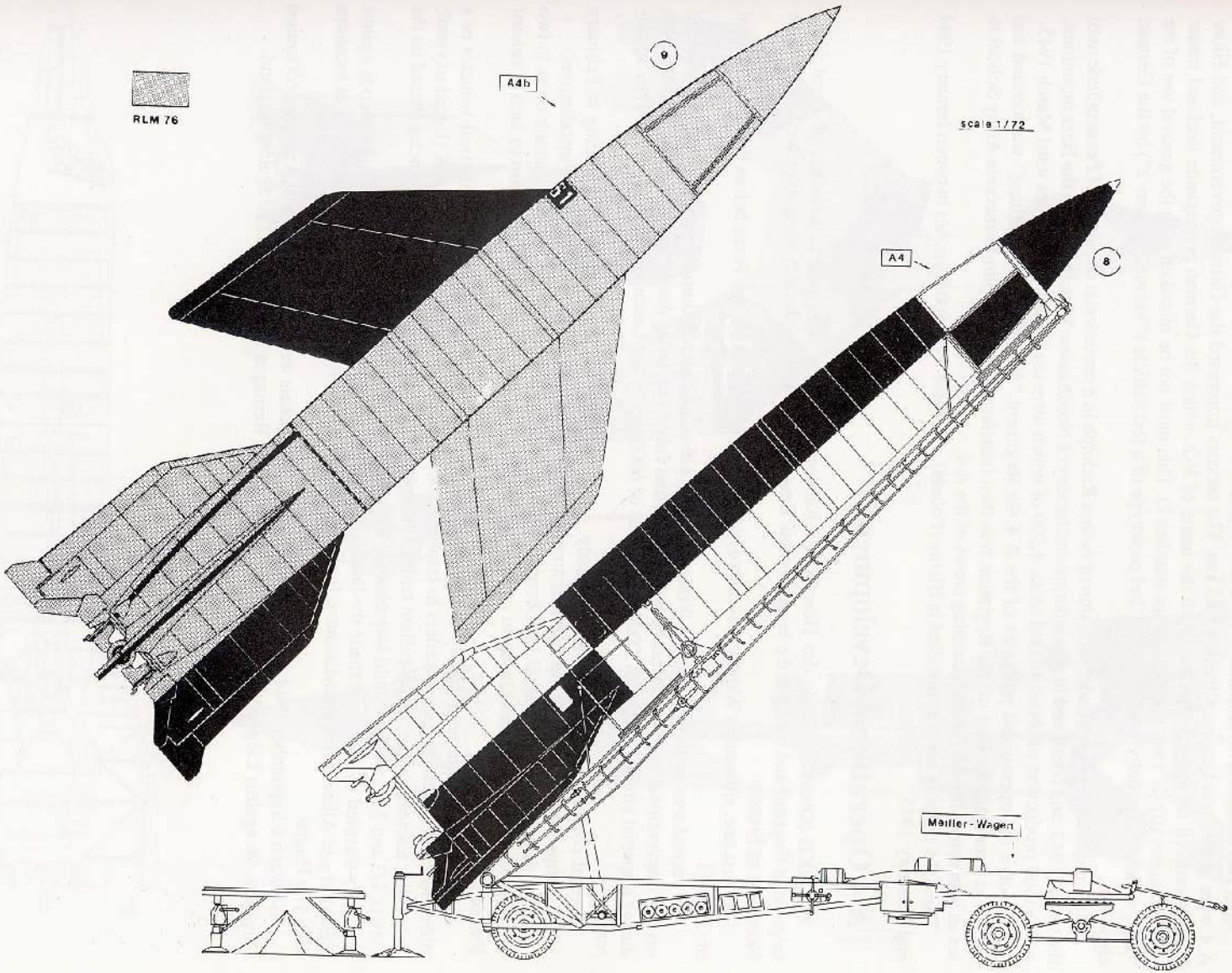
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A4b
9
scale 1/72
A4
8
Meiller-Wagen

After two unsuccessful launches in June and August, on 3rd October 1942 the first satisfactory flights of an A 4 were made, reaching an altitude of 85 km. The success impressed the German government, and Hitler himself ordered its mass production with the name of V-2, which the German propaganda declared meant "Vergeltungswaffe-2" (weapon of revenge number 2). This must not be mistaken with the general use of the "V2", which was usually applied to any 2nd prototype of a test vehicle ("Versuchsmuster 2") by the German engineers.

Mass production started under direction of Arthur Rudolph in a provisional site south of Peenemünde until the end of 1943, and continued in the underground factory of Nordhausen-Mittelwerke, in the Harz mountains, with a total production of about 10,000 units, 4,300 of which were used against the Allies until March 1945.

To solve the operational problems of the A 4 the Regiment "836 Artillery Abteilung" was created and trained at Peenemünde. Part of this Regiment was then transferred to the Köslin-Pomerania Army School to act as instructors for the future launching crews of the A 4.

The A 4's training site was installed in Blizna (Poland), and there were 600 launches between January 1944 and February 1945.

A 4 Operational Development

The OKH (Oberkommando des Heeres) had foreseen a massive campaign of launches of about 5000, targeted at England and made in the least possible time. For this use, two launch complexes were built in the Northeast of France.

The first one, situated in Watten, was destroyed by a raid of the 8th U.S. Air Force before being operational on 27-8-43.

The second was built in a quarry in Wizernes, under a die-cast concrete dome of a million tons. It withstood several conventional bombardments between March and July 1944, being destroyed on the 17th of that month during a special attack made with "Tallboy" bombs of 6000 kgs by the Lancasters of the R.A.F. 617th Squadron.

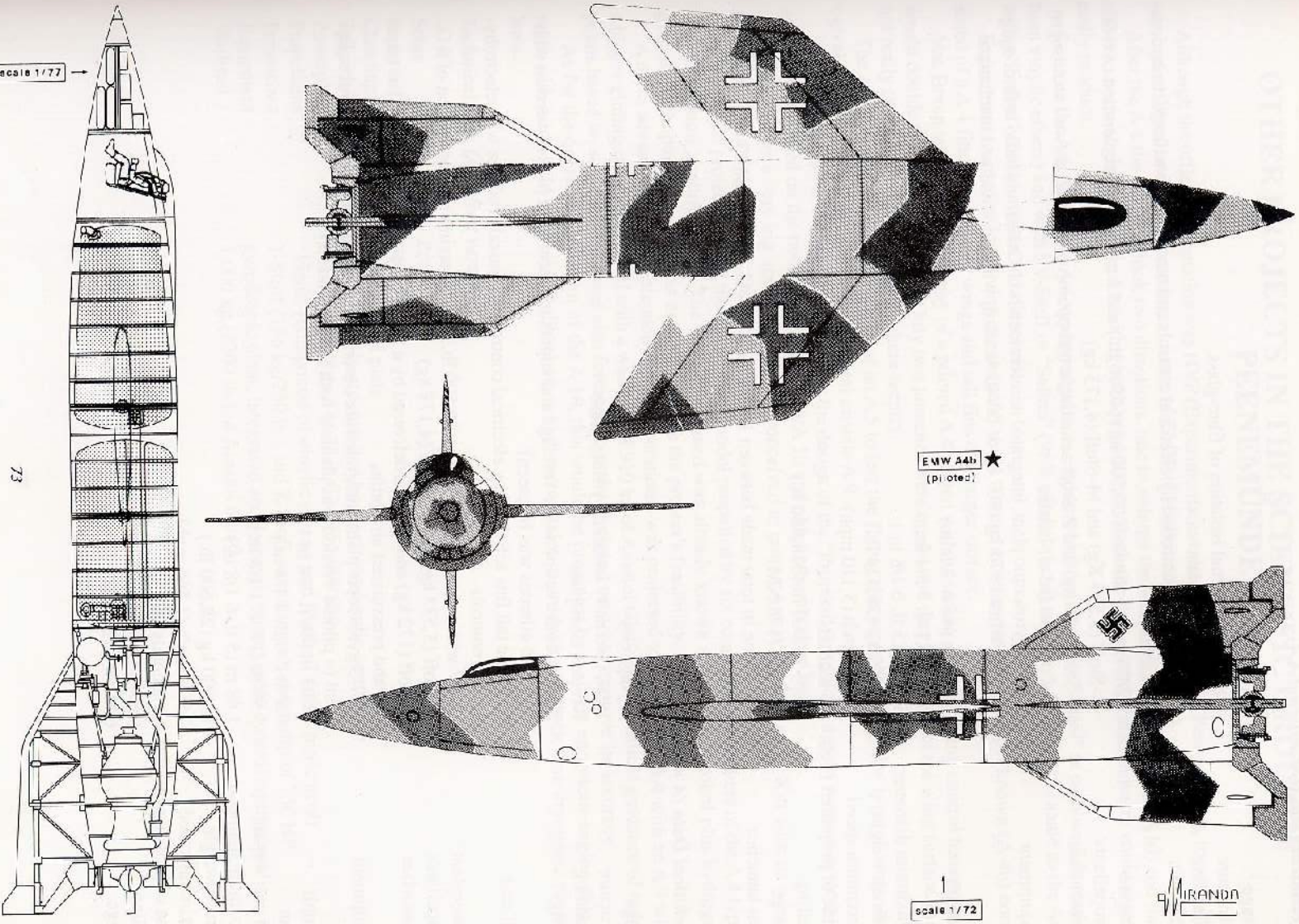
A third complex, near Sottevast, Normandy, was attacked by the R.A.F. during its building in February 1944, compelling the OKH to change their strategy, based until then on great underground installations.

They then resorted to general Dornberger's idea of creating a number of 45 mobile launch units in two different locations: Northern Group to make attacks against England, and Southern Group to launch against France and Belgium.

The mobile launch units, totally independent, were formed by a convoy of 35 specialized vehicles of a different kind: "Meillerwagen" trailers to transport the A 4; mobile plants to produce LOX (liquid oxygen); caterpillar tractors to tow the propellant tanks; and several types of armored command vehicles (based on the SdKfz 7/3 and 251) which should stay close to the rocket during launching.

They traveled by night and made the launch during the day, taking the protection given by woods against the wind and Allied Air-reconnaissance. In the beginning, some launchings were made from urban locations like The Hague.

Between 6 September 1944 and 27 March 1945, 1,341 rockets were launched against Amberes, 65 against Brussels, 98 against Liège, 15 against Paris, 11 against the Remagen bridge, and 1120 against England.


scale 1/77
EMW A4b ★
(piloted)
1
scale 1/72
MIRANDA

Technical Data (Operational A 4)

Stage	Operational
Structure	Steel with internal isolation of fibre-glass.
Cladding	Riveted steel plate
Tail unit	movable fins controlled by electrical controls and nozzle vanes with electrohydraulic controls.
Engine	EMW with a thrust of 27,500 kg (60500 lb.) and a maximum acceleration of 6 G.
Propellants	A-Stoff (5,533 Kg) and M-Stoff (4,173 kg)
Pressurizer	T-Stoff (172 kg) and Z-Stoff actuating a turbopump of 730 HP, as well as nitrogen and pressurized air bottles
Equipment	LEV-3 gyroscopic plant, integrated accelerometers (I-Gerät), and radio control equipment Warhead 975 kg (907 kg of 60/40 Amatol) with electrical and mechanical fuses
Length	14.03 m (46 ft. 3/8 in.)
Span	3.5 m (11 ft. 5 3/4 in.)
Maximum diameter	1.68 m (5 ft. 6 1/8 in.)
Launch weight	12,870 kg (28,314 lb.)
Maximum speed	5,760 km/h (3,110 mph)
Time of propelled flight	70 seconds
Ceiling	(top) 96,000 m (314,880 ft.)
Range	330 km (178 NM)
Test launches	thirty-one in total made between 13/6/42 and 9/7/43. A series of 50 was originally planned.

Technical Data (A 4b)

Stage	Flying tests
Structure	steel, internally isolated by fibre-glass
Cladding	Riveted steel plate
Wings	Similar construction to the fuselage and supersonic profile (a piloted version with movable ailerons was foreseen)
Tail unit	Movable tail fins activated by electrical controls and nozzle rudders with electrohydraulic controls
Powerplant	EMW with a thrust of 27,500 kg (60,500 lb.) and a maximum acceleration of 6 G.
Propellants	A-Stoff (5,533 kg) and M-Stoff (4,173 kg)
Pressurizer	T-Stoff (172 kg) and Z-Stoff, delivered by a turbopump of 730 HP, as well as nitrogen and pressurized air bottles
Equipment	LEV-3 gyroscopic plant, integrated accelerometers (I-Gerät) and radio control equipment (a piloted version was planned with flying controls)
Length	14.03 m (46 ft. 3/8 in.)
Span	6.2 m (20 ft. 4 1/8 in.)
Tail unit's span	3.99 m (13 ft. 1 1/8 in.)
Maximum diameter	1.68 m (5 ft. 6 1/8 in.)
Launch weight	13,000 kg (28,600 lb.)
Maximum speed	2,900 km/h (1,566 mph)
Time of propelled flight	68 seconds
Ceiling	(top) 95,000 m (311,600 ft.)
Range	600 km (324 NM)

OTHER PROJECTS IN THE SCIENTIFIC GROUP OF PEENEMÜNDE

Although the official designation was HVP (Experimentation site of the Army in Peenemünde), its activity was camouflaged under the commercial name of EMW (Elektromechanische Werke).

After the A 4 the research took two directions, one to enlarge the weapon's range (A 4b, A9/A10) and the other to obtain engines capable of working with propellants which the damaged German industry could more easily produce.

So arose the A 6, based on a A 4, equipped with an engine which worked with "Visol" (a combustible made from vinylic ethers) and with SV-Stoff or "Salbei" (98% of nitric acid) and the A 8, nearly the same as the A6 with a "Salbei" rocket engine and diesel oil.

Experiments aimed at improving the range of the A 4 were most important. The best known (A 4b) consisted of a A 4 fitted with swept wings and tail fins of a larger surface.

Von Braun tells in his biography of a piloted A 4b fitted with a landing gear for flying control tests which would double the range of the A 4. Only two launches were made, and they showed that the wing surface was not really the most suitable for atmosphere reentry.

The A 7 was built with the fuselage of an A 5 to test the flying characteristics of a new type of wing (the ogival delta) intended for the intercontinental missile A 9.

The Army's answer to American raids was the design of the "Projektil Amerika", a giant weapon system of a great range based on the two-stage missile A 9/A 10 and able to bomb New York.

The A 10 was a very big accelerator rocket conceived to put an A 4 at a height of 24 Km with its whole propellant to multiply its range.

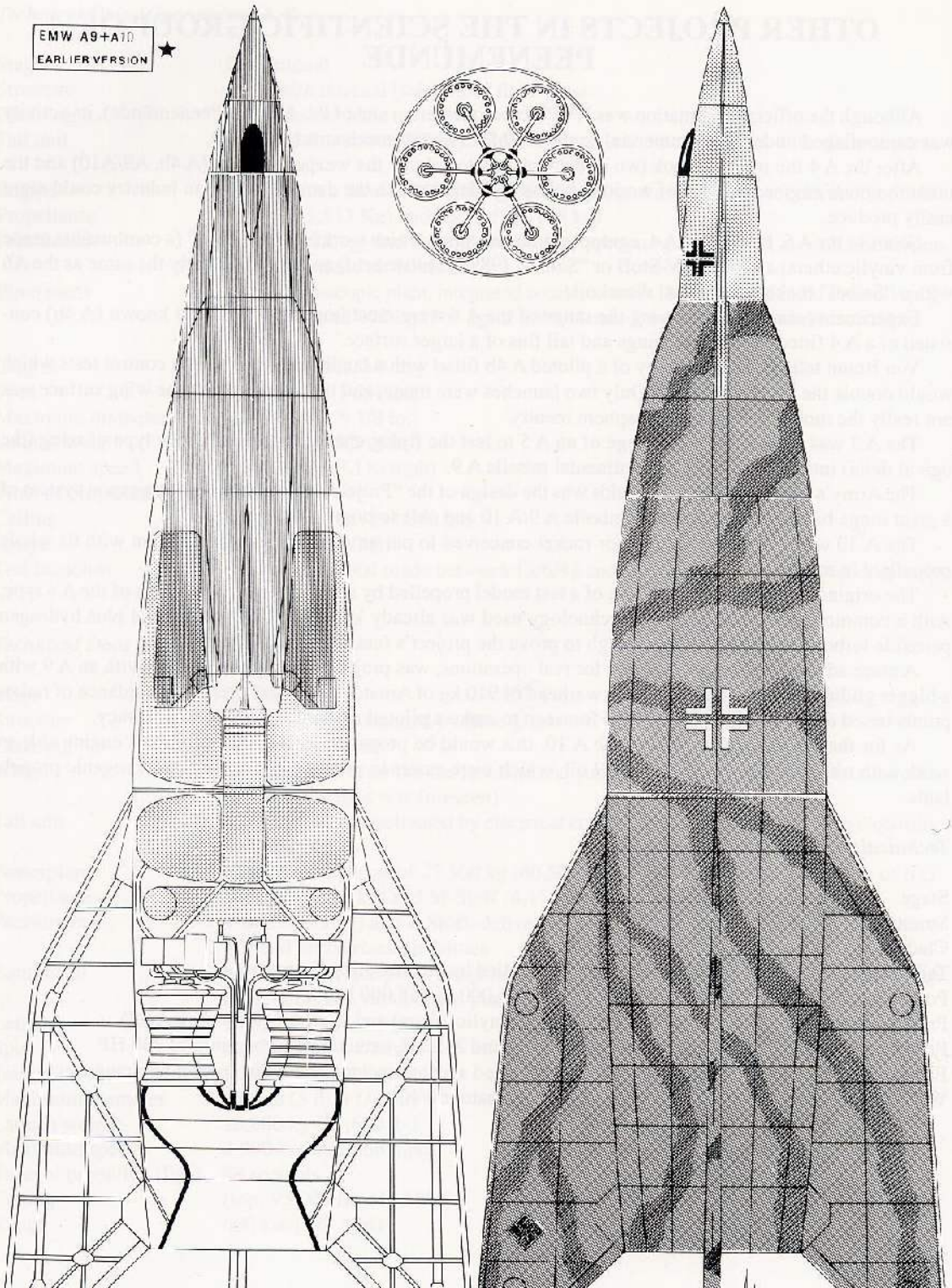
The original project implied the use of a test model propelled by six combustion chambers of the A 4 type, with a common Venturi nozzle. The technology used was already known (LOX, and alcohol plus hydrogen peroxide turbopumps), and it was enough to prove the project's feasibility.

A more advanced version, intended for real operations, was projected to replace the A 4 with an A 9 with a bigger gliding range, and fitted with a warhead of 910 kg of Amatol 60/40 and a terminal guidance of radar-points based on submarines. It was also foreseen to make a piloted model to improve its accuracy.

As for the operational version of the A 10, this would be propelled by a single enormous engine able to work with nitric acid (Salbei) and diesel oil, which were easier to produce and stock than cryogenic propellants.

Technical data (A 9, first version)

Stage	Project
Structure	steel
Cladding	Riveted steel plate
Tail unit	movable tail fins controlled by electrohydraulic controls
Powerplant	EMW with a thrust of 25,000 kg (55,000 lb.)
Propellants	"Visol" (compound of vinylic ethers) and "Salbei" (98% nitric acid)
Pressurizer	T-Stoff (186 kg/260 lb.) and Z-Stoff, actuating a turbopump of 730 HP
Equipment	gyroscopic plant, integrated accelerometers, and radio control equipment.
Warhead	1,000 kg (2200 lb.) of Amatol 60/40


EMW A9+A10
EARLIER VERSION

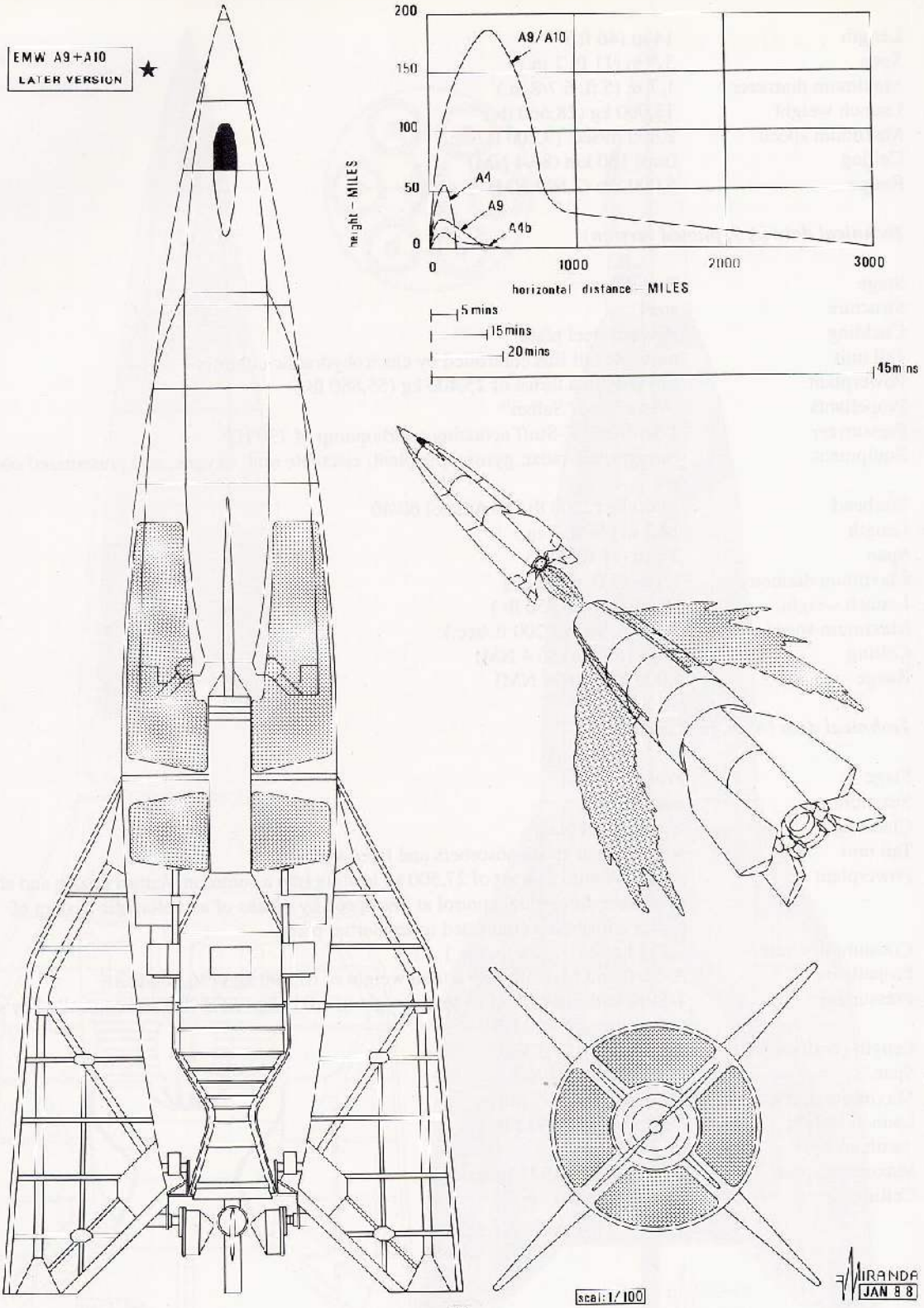
Length	14 m (46 ft.)
Span	3.5 m (11 ft. 7 in.)
Maximum diameter	1.7 m (5 ft. 6 7/8 in.)
Launch weight	13,000 kg (28,660 lb.)
Maximum speed	2,800 m/sec. (9,200 ft./sec.)
Ceiling	(top) 160 km (86.4 NM)
Range	5,000 km (2,699 NM)

Technical data (A 9, piloted version)

Stage	Project
Structure	steel
Cladding	Riveted steel plate
Tail unit	movable tail fins controlled by electrohydraulic controls
Powerplant	EMW with a thrust of 25,400 kg (55,880 lb.)
Propellants	"Visol" and "Salbei"
Pressurizer	T-Stoff and Z-Stoff actuating a turbopump of 730 HP
Equipment	cartographic radar, gyroscopic plant, ejectable seat, oxygen, and pressurized cockpit.
Warhead	1,000 kg (2200 lb.) of Amatol 60/40
Length	14.2 m (46 ft. 7 in.)
Span	3.5 m (11 ft. 7 in.)
Maximum diameter	1.7 m (5 ft. 6 7/8 in.)
Launch weight	16,260 kg (35,850 lb.)
Maximum speed	2,800 m/sec. (9,200 ft./sec.)
Ceiling	(top) 160 km (86.4 NM)
Range	5,000 km (2,699 NM)

Technical data (A 10, first version)

Stage	Project
Structure	steel
Cladding	riveted steel plate
Tail unit	with internal shock absorbers and fixed surfaces
Powerplant	six EMW with a thrust of 27,500 kg leading into a common Venturi nozzle and able to make a differential control at low speed by means of an automatic system of power adjustment connected to an inertial plant.
Consumption rate	1,237 kg/sec. (2728 lb./sec.)
Propellants	A-Stoff and M-Stoff with a total weight of 61,490 kg (136,700 lb.)
Pressurizer	T-Stoff and Z-Stoff with a total weight of 1,032 kg (2270 lb.) and controlled by six turbopumps of 730 HP
Length (with an A 9)	25.8 m (84 ft. 7 3/4 in.)
Span	9 m (29 ft. 6 1/4 in.)
Maximum diameter	4.3 m (14 ft. 1 1/5 in.)
Launch weight (with an A 9)	99,960 kg (219,912 lb.)
Maximum speed	1,200 m/sec. (3,937 ft./sec.)
Ceiling	24 km (13 NM)


EMW A9+A10
LATER VERSION
200
150
100
50
0
A9/A10
A4
A9
A4b
0
1000
2000
3000
horizontal distance – MILES
5 mins
15 mins
20 mins
45 mins
scal: 1/100
MIRANDA
JAN 88

Technical data (A 10, second version)

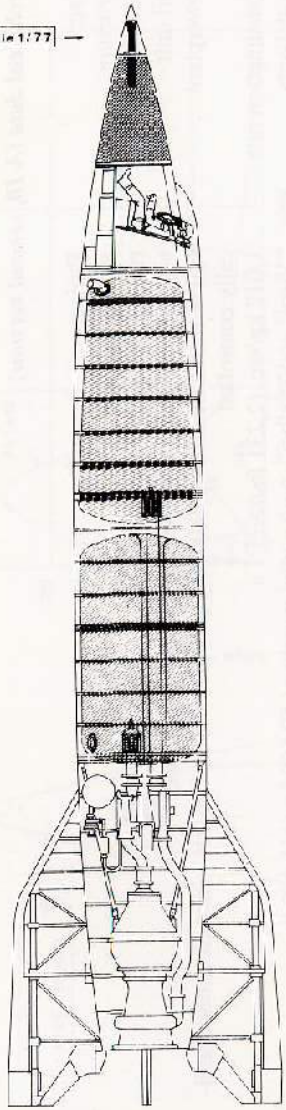
Stage	Project
Structure	steel
Cladding	riveted steel plate
Tail unit	with internal shock absorbers and with fixed surfaces
Powerplant	EMW with a thrust of 200,000 kg (440,000 lb.) and nozzle vanes electrohydraulically controlled
Consumption rate	1,012 kg/sec. (2,231 lb./sec.)
Propellants	"Visol" and "Salbei", with a total weight of 50,560 kg (111,232 lb.)
Pressurizer	T-Stoff and Z-Stoff with a total weight of 1,500 kg, controlled by several bombs of unknown design and power
Length (with an A 9)	25.8 m (84 ft. 7 3/4 in.)
Span	9 m (29 ft. 6 1/4 in.)
Maximum diameter	4.3 m (14 ft. 1 1/5 in.)
Launch weight (with an A 9)	85,320 kg (187,704 lb.)
Maximum speed	1,200 m/sec. (3,940 ft./sec.)
Ceiling	24 km (13 NM)

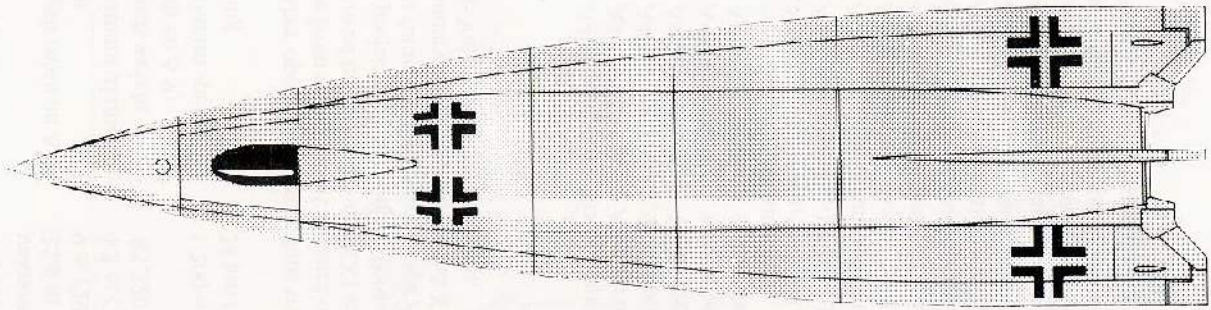
Another operational procedure was envisaged for the A-4 in order to reach the North American continent: firing from sea at a short distance off the coast, where the missile should be transported in submersible containers towed by the new Type XXI submarines.
This project of Wolfsburg-Volkswagen (Test Stand XII) is dated at the end of 1944 and it wasn't made effective when future performances of the A 9/A 10 were known.
In January 1945 the "Test Stand XII" was canceled when several containers had been already built and tested in the Vulcan-Stettin dockyards.

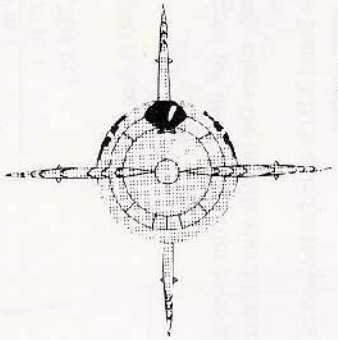
KEY TO THE ILLUSTRATIONS

1. A4 seized by the British, launched from Cuxhaven at the end of 1945.
2. A4 launched in the Autumn of 1943 from the site near the river San in Poland.
3. A4, test vehicle no. 28, launched from Peenemünde on 22 June 1943. Destroyed in flight.
4. A4, test vehicle no. 10, destroyed when taking off from Peenemünde on 7 January 1943.
5. A4, test vehicle no. 3, launched from Peenemünde on 16 August 1943. Destroyed during its flight.
6. A4, test vehicle no. 4, launched from Peenemünde on 3 October 1942. Perfect flight.
7. A4, seized by the Americans, launched from White Sands on 13th June 1946.
8. A4, seized by the British and launched from Cuxhaven at the end of 1945.
9. A4b, test vehicle no. 1, launched from Peenemünde on 24 January 1945.
10. A4, test vehicle, launched from the San River during the Summer of 1943.
11. A4, operational, Peenemünde, 1944.
12. A4, test vehicle, launched from Blizna by the "836 Artillery Abteilung" in November 1943.
13. A4, operational vehicle no. 11/W4171, Peenemünde, 1944.
14. A4, operational vehicle no. 11/W4156, Peenemünde, 1944.
15. A4, test vehicle. Unknown unit.
16. A4, operational, launched on 27 September 1944 by the "485 Artillery Abteilung".
17. A4, test vehicle, launched from the site near the river San during the Summer of 1943.

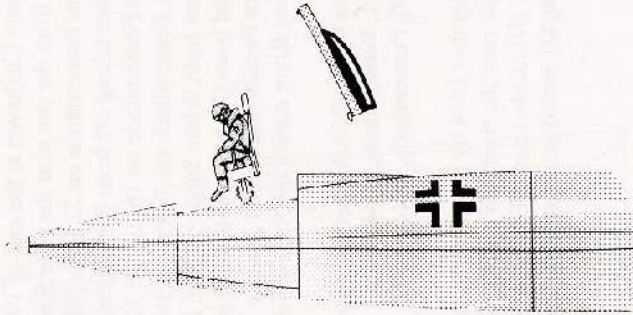
(A) fuse, (B) warhead, (C) control section, (D) alcohol tank, (E) structure, (F) liquid oxygen tank, (G) hydrogen peroxide tank (H) combustion chamber, (J) aerodynamic rudders, and (K) nozzle vanes.

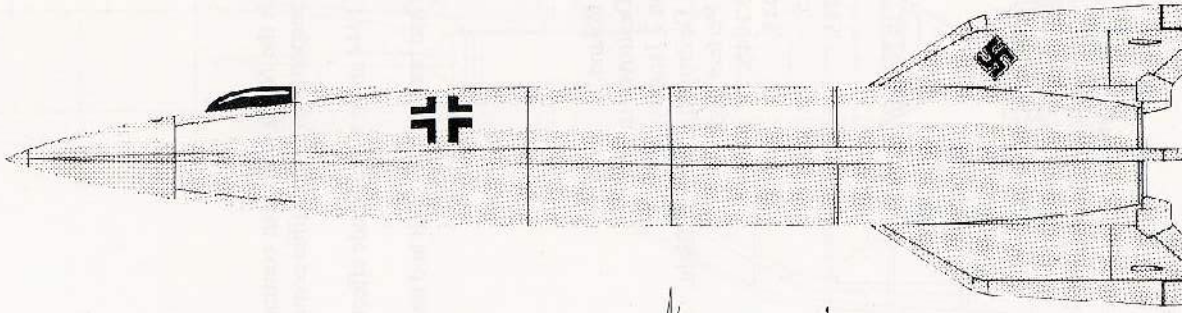






EMW A9 ★





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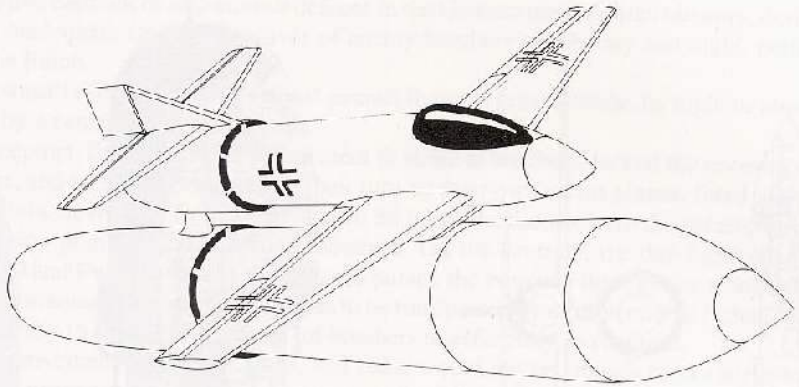


BLOHM UND VOSS MGRP (Manuell Gesteuertes Raketen Projektil)

This was a project for a bombing rocket to be guided close to the target by a parasite plane.

The weapon and parasite planes were carried up to 180 miles from the target (a city) on the back of a Dornier Do 217 which, before release, went into a shallow dive to allow the ignition of the ram-jet. This quickly climbed to a stratospheric height, from where the pilot located the target by radar and released the main rocket in a ballistic trajectory with a maneuver of an estimated 20 G.

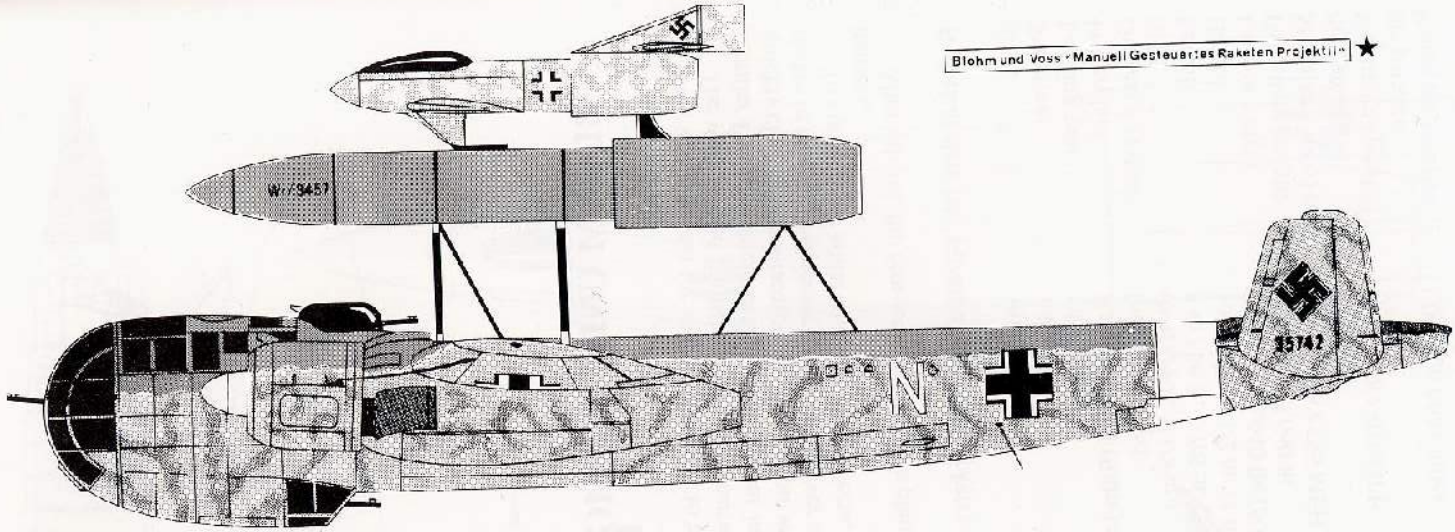
To compensate some of the G force effects, the pilot traveled in a prone position over a shock absorber harness.

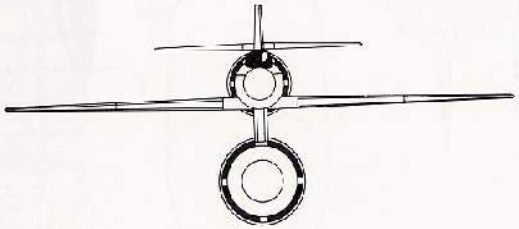
After release, the ram-jet of the parasite plane ignited. The plane kept the tanks full for its way back.

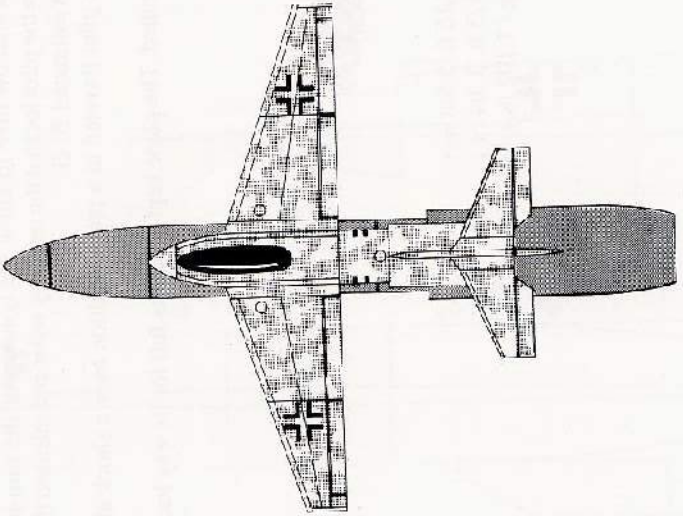
Technical data (the parasite plane in brackets)

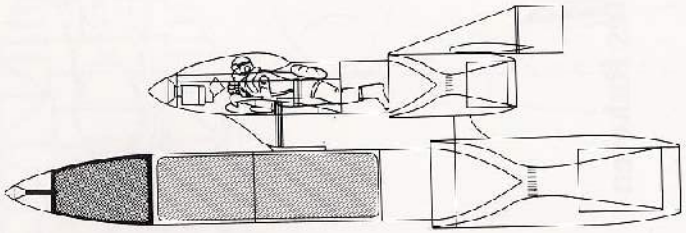
Stage	Project
Structure	metallic
Landing gear	(skids)
Powerplant	Ram-jet Lorin (Ram-jet Lorin)
Guidance system	inertial (piloted)
Span	(6 m /19 ft. 8 1/8 in.)
Length	8 m / 26 ft. 2 7/8 in. (5 m / 16 ft. 3 5/8 in.)
Height	1 m / 3 ft. 6 1/2 in. (1.62 m /5 ft. 3 3/4 in.)
Launch weight	1,200 kg / 2,640 lb. (500 kg / 1,102 lb.)
Propellant weight	2,300 kg / 5,060 lb.
Maximum speed of the compound	1,000 km/h / 556 MPH
Maximum speed of the parasite	720 km/h / 403 MPH
Range with carrier	1.000 km / 621 miles

Blohm und Voss - Manuell Gesteuertes Raketen Projektil ★









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THE DEFENSE OF THE REICH

The primitive network of anti-aircraft defense in the German metropolitan territory, designed in 1939, soon proved to be inadequate against the waves of enemy bombers which, day and night, pounded the cities and industry of the Reich.

The Flak wasn't efficient enough against aircraft flying at great altitude, by night or above the clouds, even when helped by a centralized radar control.

Day interceptors, fitted with heavy armament to strike at bombers, lacked the necessary agility to face the Allied fighters, and had to be protected on their turn by their own escort planes, fitted with light armament.

Night fighters, developed from Do 17 and Ju 88 bombers, did not have the necessary speed to efficiently reach interception points or even to chase bombers. On the contrary, the day fighters converted into night fighters (Bf 110 and Fw 190) lacked the range to pursue the bombers through the whole attack.

As for the armament, the heavier guns able to be transported by a conventional fighter lacked the necessary range and accuracy to disable the "boxes" of bombers as efficiently as required.

Simple improvement of fighters, guns, and radar would not be enough for a satisfactory solution of the problem. It was necessary to create a new weapon: the anti-aircraft remotely actuated missile.

The first air to air missiles evolved from Hs 293 guided bombs and resulted in a more streamlined and maneuverable version known as Hs/298. At the same time the Ruhrstahl-Kramer X-4 was developed and, having superior performances, was the predecessor of the modern anti-aircraft interception systems.

As for the weapons shot from ground-based batteries, there were five projects of surface to air missiles in 1944 in different stages of development.

- The "Schmetterling", designed to operate at medium and low heights.
- The "Rheintochter" by Rheinmetall-Borsig, able to reach a height of 7 Km.
- The "Enzian", by Messerschmitt, based on the aerodynamics of the "Komet" and considered superior in characteristics to the "Rheintochter".
- The "Feuerlilie" by the LFA, a research project not assigned to mass production.
- The "Wasserfall" by the HVP, based on the powerful rocket A 4.

At the end of 1944, a ministerial commission advised by general Dornberger decided to stop the development of these weapons, except for the "Schmetterling" and the "Wasserfall", to rationalize production and prepare the new defensive pattern which would be fully operational in 1946. This program, of considerable scope, included the future defense of the 70 German cities with populations over 100,000. The installation of 1800 "Schmetterling" and 1200 "Wasserfall" batteries, the latter situated in "Vesuvius" installations protected by die-cast concrete, was foreseen.

Besides, a defensive perimeter of 15,000 km was designed around the vital areas of the Reich, which should have required 1300 "Schmetterling" and 870 "Wasserfall" batteries, supported by unguided missile launchers of the "Taifun" type and conventional Flak batteries.

Detection and tracking would have been made by a great network of electronic devices classified under the codes "Brabant", "Burgund", "Hansa", "Lohengrin", and "Parsifal".

With the scarcity of supplies, production collapse, and the Allied troops' advance stopped the operational service of the new anti-aircraft units, although many test launches were made during the last months of the war, thus showing the technical feasibility of the system.

RUHRSTAHL-KRAMER X4

The first guided missile with air to air capability successfully used during the Second World War.

Developed by Dr. Kramer's team to be launched from high performance day fighters against American bomber formations from a safe distance. Basic design (at the beginning of 1943) was fitted with straight wings, but the final version for serial production had arrowed wings to decrease air resistance when the missile was carried by jet planes.

The X4 was wire guided from the carrier fighter to the target proximity, where it automatically exploded by means of an acoustic fuse.

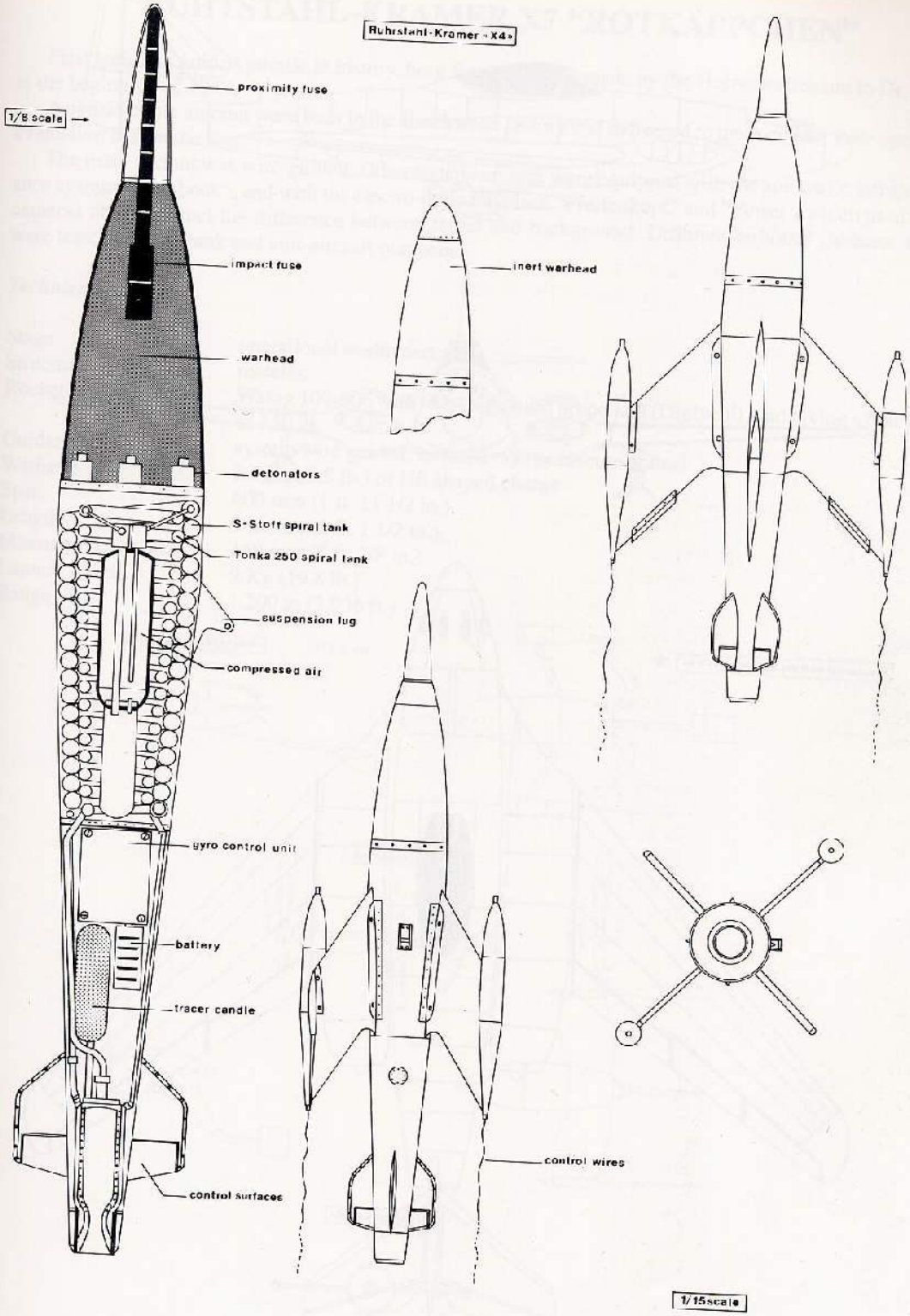
At the end of the war, 1,300 missiles had been manufactured. Most of them never received their engines since the BMW factory in Stargard, where they were produced, had been seriously damaged by the Allied bombers.

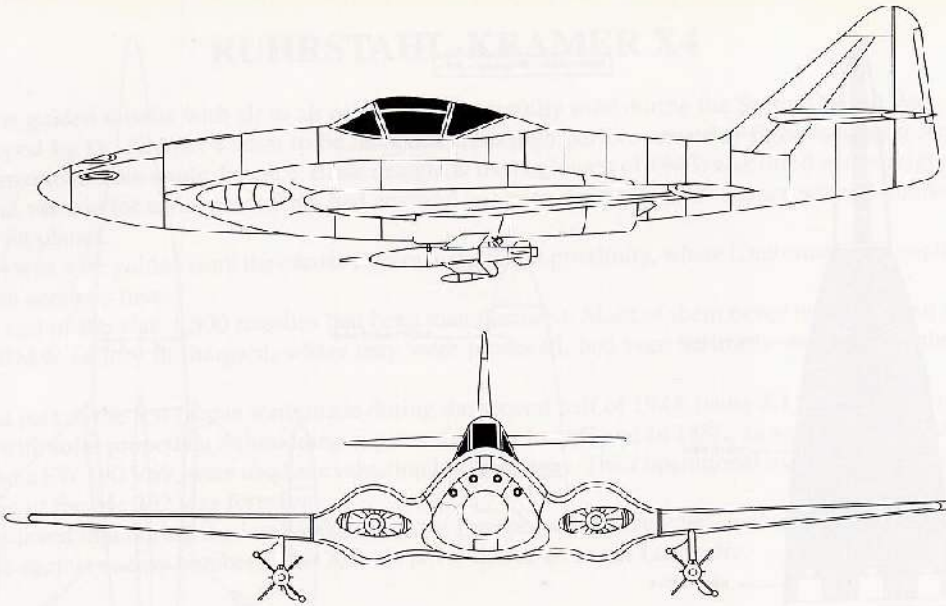
A great part of the test flights were made during the second half of 1944, using X4 missiles provisionally equipped with solid propellant Schmidding engines. Junkers Ju 88G and Ju 188L, as well as three Focke Wulf 190 F-8 and a FW 190 V69, were used as evaluation launch planes. Their operational use by the most advanced day version of the Me 262 was foreseen.

It is believed that during the last weeks of war in Europe, several launches, included in the test program, were made against enemy bombers. The X4 was never delivered to the Luftwaffe.

Technical data

Stage	Operational tests
Type	Short range air to air missile
Wings	Plywood
Fuselage	Aluminum coating
Tail unit	Aluminum coating
Powerplant	BMW of liquid propellant with a thrust between 140 and 30 kg (308 to 66 lb.)
Propellants	Tonka 250 (1.6 kg/3.5 lb.) and S-Stoff (6.4 kg/1.41 lb.)
Pressurizer	Compressed air
Fuel tank	spiral, installed around the engine and with a piston actuated by compressed air running through it
Warhead	20 kg (44 lb.) of HE with proximity fuses "Dogge" and "Meise" activated by the noise of target bombers.
Guidance system	Wire guided by the system FuG 510 with "Düsseldorf" transmitter and "Detmold" receiver. The guidance wires were lodged in two coils fixed to wing tips and automatically unwound in flight.
Wingspan	0.725 m (2 ft. 4 5/8 in.)
Length	2 m (6 ft. 6 3/4 in.)
Maximum diameter	0.222 m (8 ft. 5/8 in.)
Launch weight	60 kg (132 lb.)
Maximum speed	893 km/h (482 mph)
Range	3,200 m (10,496 ft.)


Ruhrstahl-Kramer «X4»
1/8 scale
proximity fuse
impact fuse
warhead
detonators
S-Stoff spiral tank
Tonka 250 spiral tank
suspension lug
compressed air
gyro control unit
battery
tracer candle
control surfaces
inert warhead
control wires
1/15 scale



Messerschmitt Me 262 HG III «X4» ★

1/72 scale

RUHTSTAHL-KRAMER X7 "ROTKÄPPCHEN"

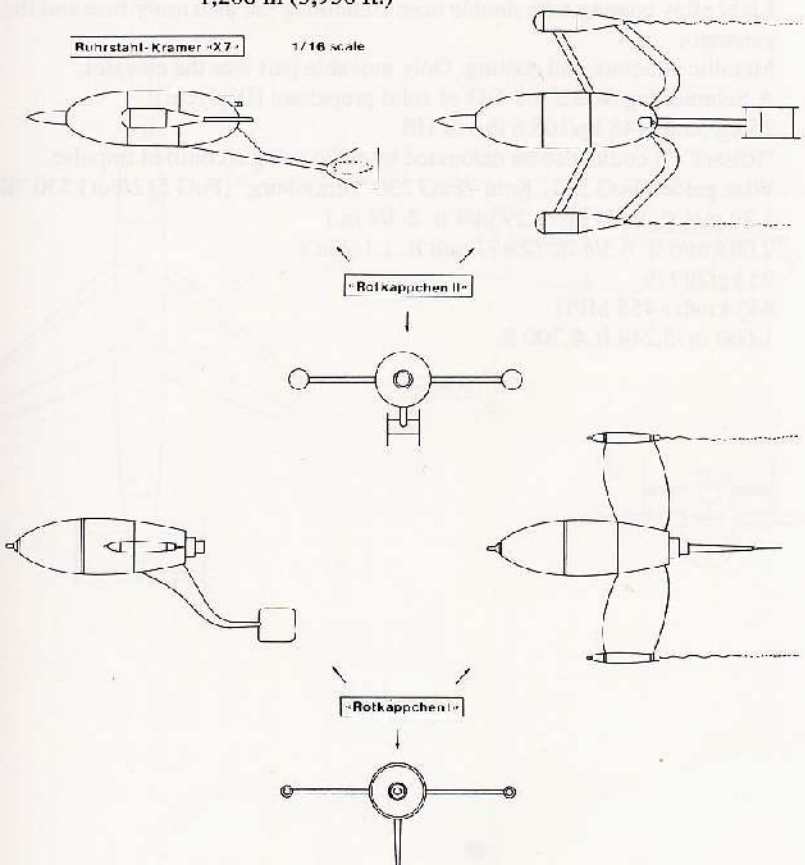
First anti-tank guided missile in history, born from the order made by the Heereswaffenamt to Dr. Kramer at the beginning of 1944.

A considerable amount were built in the Brackwede factory and delivered to the Army for their operational evaluation before the war.

The main variant was wire-guided. Other tested versions were equipped with the automatic infrared guidance system "Steinbock", and with the electro-optic guidance "Pfeifenkopf" and "Pinsel", which used vidicon cameras able to detect the difference between target and background. Different airborne guidance systems were tested for anti-tank and anti-aircraft purposes.

Technical Data

Stage	operational evaluation
Structure	metallic
Rocket motor	Wasag 109-506 with two-stage solid propellant (Diglycol), and giving a boost thrust of 150 lb.
Guidance	system wire guided, infrared rays or electro-optical
Warhead	2.5 Kg (5.5 lb.) of HE shaped charge
Span	600 mm (1 ft. 11 1/2 in.)
Length	950 mm (3 ft. 1 1/2 in.)
Maximum Diameter	150 mm (5 ft. 7/8 in.)
Launch weight	9 Kg (19.8 lb.)
Range	1,200 m (3,936 ft.)



HENSCHEL Hs 298

This remotely actuated air to air missile was based on a project by Dr. Wagner in 1941. This was then rejected and again proposed in 1943. Series manufacturing began that same year in the Henschel factory at Schönefeld, near Berlin, under direction of engineer Hesky.

Readiness was delayed due to a late delivery of the proximity fuse "Rüssel".

The first launch was made from a Junkers Ju 88 A-4 on 22 December 1944.

For its operational evaluation, three hundred missiles had to be launched from the experimental site of Karlshagen, using the heavy night fighters Junkers Ju 88 G-1, Ju 388 J-1, and Dornier Do 217J. Some were probably launched against true targets.

Tests showed that the optimum launch should be made from behind the target with a maximum deflection of 30 degrees.

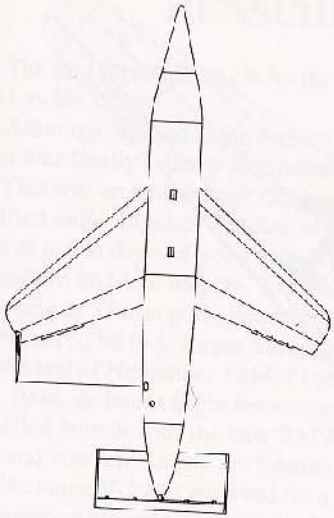
The missile was radio guided from the launch plane and was vulnerable to electronic counter-measures.

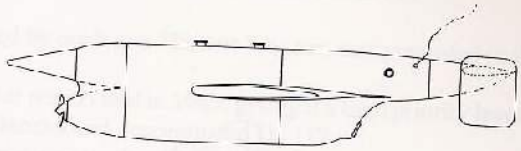
A more powerful and heavier version was proposed to be wire guided. Some test units of this version, which was called Hs 298 V2, were manufactured before the end of the war.

A stock of 135 freshly finished missiles of the first version were destroyed during an attack by the Soviet Air Force on the Wansdorf factory, where they had been stored.

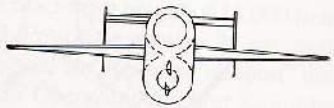
Technical data (V2 in brackets)

Stage	Operational test
Type	Air to air missile of short range
Wings	Wood structure and coating, ailerons
Fuselage	Light alloy coating with double nose containing the proximity fuse and the electric generator
Tail unit	Metallic structure and coating. Only movable part was the elevator.
Powerplant	A Schmidding SG32/109-543 of solid propellant (Diglycol)
Warhead	25 kg/55 lb. (48 kg/105.6 lb.) of HE
Proximity fuse	"Rüssel". It could also be detonated by radio using a codified impulse.
Guidance system	Wire guided FuG 203 "Kehl"/FuG 230 "Strassburg" (FuG 512/FuG 530 "Kogge").
Wingspan	1.29 m/4 ft. 2 3/4 in. (1.29 m/4 ft. 2 3/4 in.)
Length	2.003 m/6 ft. 6 3/4 in. (2.477 m/8 ft. 1 1/2 in.)
Launch weight	95 kg/209 lb.
Maximum speed	842 km/h / 455 MPH
Range	1,600 m /5,248 ft./8,200 ft.





Hs 298 V1



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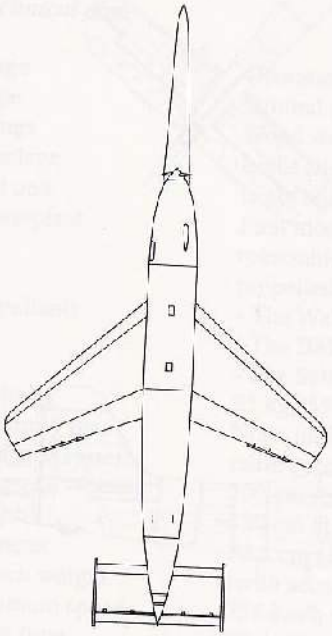
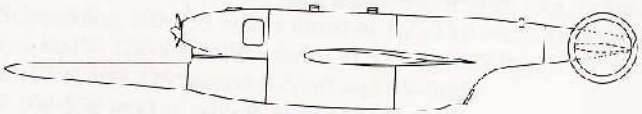
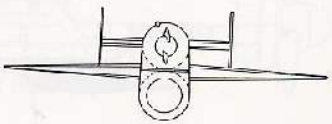
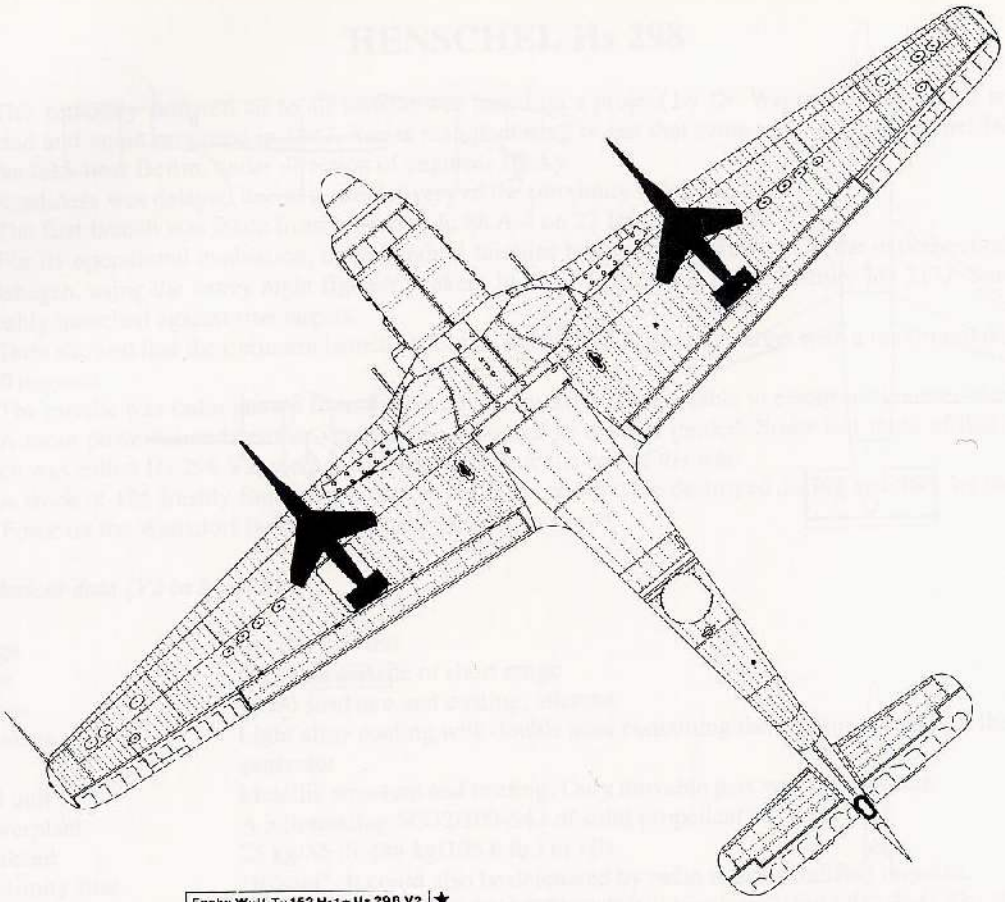


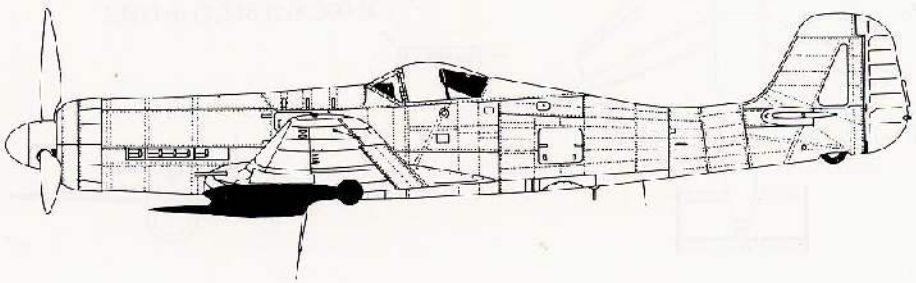


Hs 298 V2





Focke Wulf Ta 152 H-1 + Hs 298 V2 ★



1/72 scale

HENSCHEL HS 117 "SCHMETTERLING"

The initial project, made by the team directed by professor Herbert Wagner, was presented to the RLM in 1941 as IIs 297.

Although rejected at the beginning, it was later reactivated in 1943, giving it a high priority level. Development was finally ordered to graduate engineer Henrici and denominated Hs 117.

This was an anti-aircraft radio guided missile with a warhead which was remotely exploded by means of a codified radio impulse. The first series did not have proximity fuses to accelerate production, thus limiting its tactical use to day and good visibility operations. It was optimized for target defense against planes attacking at medium and low heights. To diminish reaction time, the launch was made from a reconverted anti-aircraft mounting of 37 mm guns, helped by two accelerator rockets of solid propellant. Joint thrust at take off reached 3,300 kg (7,280 lb.). Target tracking was made by the radio control system Kehl/Strassburg. Between 1 May and the end of November 1944, 21 test launches were made reaching a height of 11,000 m in actuated flight. In May 1944, different flight tests were made of the Hs 117H. Prototype number 28 successfully made the first propelled launch with the new BMW 109-558. It was proposed as "Revenge weapon" under "V-3" designation, and was rejected by the Commission directed by the SS Obergruppenführer Kammler.

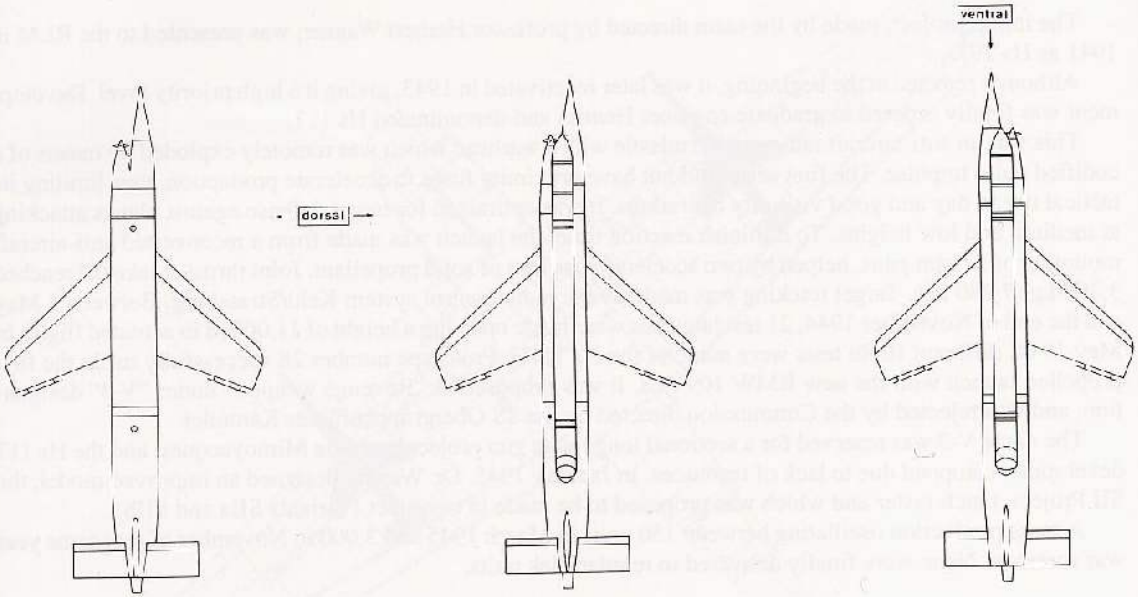
The name V-3 was reserved for a sectional long range gun project based on Mimoyecques, and the Hs 117 development stopped due to lack of resources. In January 1945, Dr. Wagner designed an improved model, the SII Project, much faster and which was proposed to be made in two sizes (variants SIIa and SIIb).

A mass production oscillating between 150 units in March 1945 and 3,000 in November of that same year was foreseen. None were finally delivered to regular Flak units.

Technical data

Stage	Operational tests
Type	Ground to air missile of medium range
Wings	Wood structure and coating. Roll control by "Wagner bars"
Fuselage	Light alloy structure and revetment
Tail unit	Light alloy structure and revetment
Powerplant	First models used a Walter HWK 109-729 with a thrust of 375 kg, helped by two releasable Schmidding 109-553 with a thrust of 1,750 kg each. Model Hs 117 was propelled by a BMW 109-558 with a thrust of 375 kg (827 lb.).
Propellants	- The Walter IIWK 109-729 burned B-Stoff and SV-Stoff - The BMW 109-558 worked with R-Stoff and SV-Stoff - The Schmidding used solid propellant (Diglycol)
Warhead	25 kg (55 lb.) of HE
Proximity fuse	None in first models. Some of last launch tests were made using the FUCHS fuse.
Guidance system	radio controlled with equipment FuG 203/FuG 230 Kehl/Strassburg
Wingspan	200 cm (6 ft. 6 3/4 in.)
Length	430 cm (14 ft. 1 1/5 in.)
Diameter	33.5 cm (1 ft. 1/8 in.)
Launch weight	(with accelerator rockets) 440 kg (970 lb.)
Maximum speed	756 km/h (416 MPH)
Flight time	33 to 57 sec.
Range	32 km (17.7 m/miles)
Effective ceiling	10,000 m (32,800 ft.)

Henschel Hs 117 "Schmetterling"



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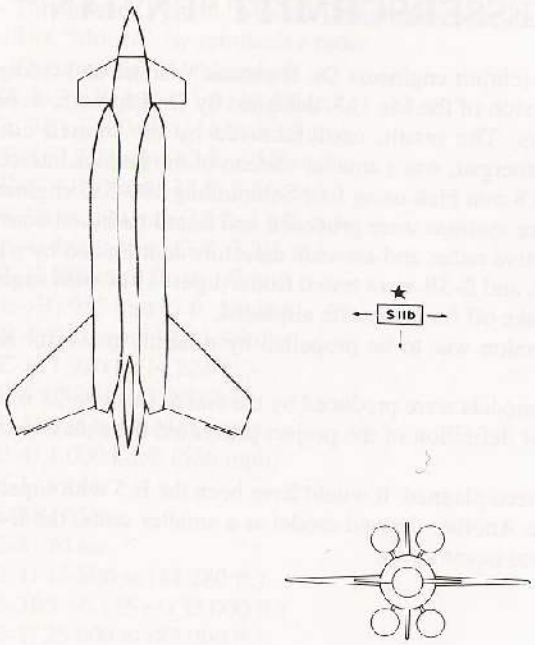

Henschel Hs 117 »Schmetterling«

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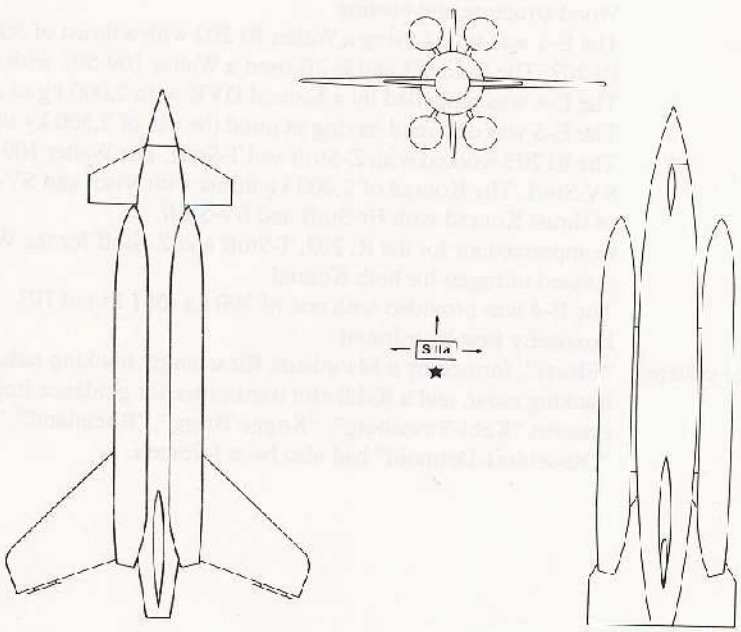


MESSERSCHMITT "ENZIAN"

At the end of 1943, Messerschmitt engineers Dr. Hermann Würster and George Madelung received the order to build a non-piloted version of the Me 163, designed by Dr. Lippisch, to be radio guided against the Allied formations of bombers. The result, manufactured by the branch company Oberbayerischen Forschungsanstalt Oberammergau, was a smaller version of the famous interceptor, able to take off from a converted gun carriage of a 8.8 mm Flak using four Schmidding 109-553 engines of solid propellant.

Many tracking and guidance systems were proposed and tested based on convergent beams of radar, remote control, infrared, semi-active radar, and acoustic detectors coordinated by a primitive fire control computer. Prototypes E-1, E-2, E-3, and E-3B were tested from August 1944 with engines based on the Walter Ri 202 accelerator used to boost take off for Luftwaffe airplanes.

The E-4 manufacturing version was to be propelled by a highly powerful Konrad DVK of simplified maintenance.

A total of 60 Enzian of all models were produced by the end of the war, 28 of them of type E-4.

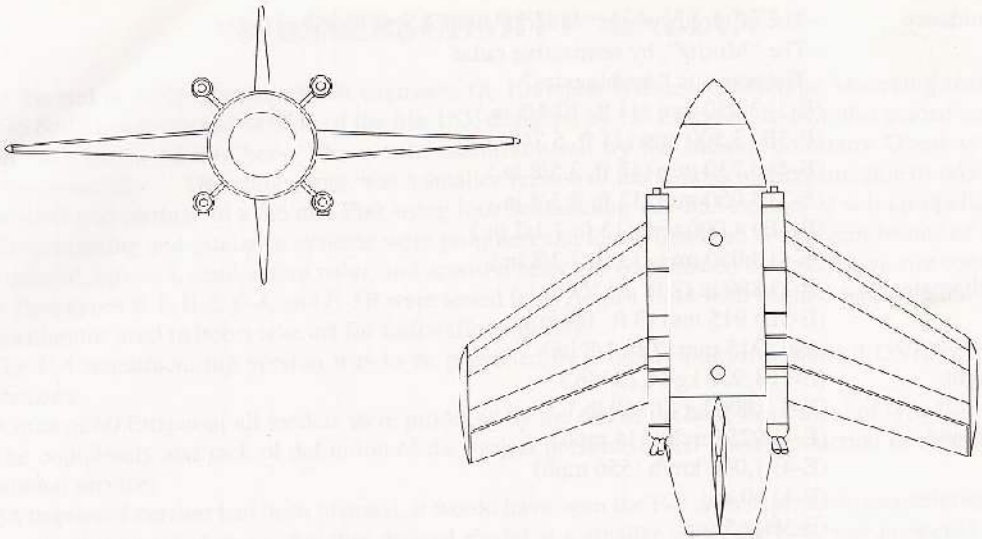
The complexity and lack of definition of the project prevented their mass production in time to get into operational service.

An improved version had been planned. It would have been the E-5 with supersonic characteristics, but it never passed the project stage. Another derived model at a smaller scale, the E-6, was projected as a wire guided anti-tank missile and was never made.

Technical data

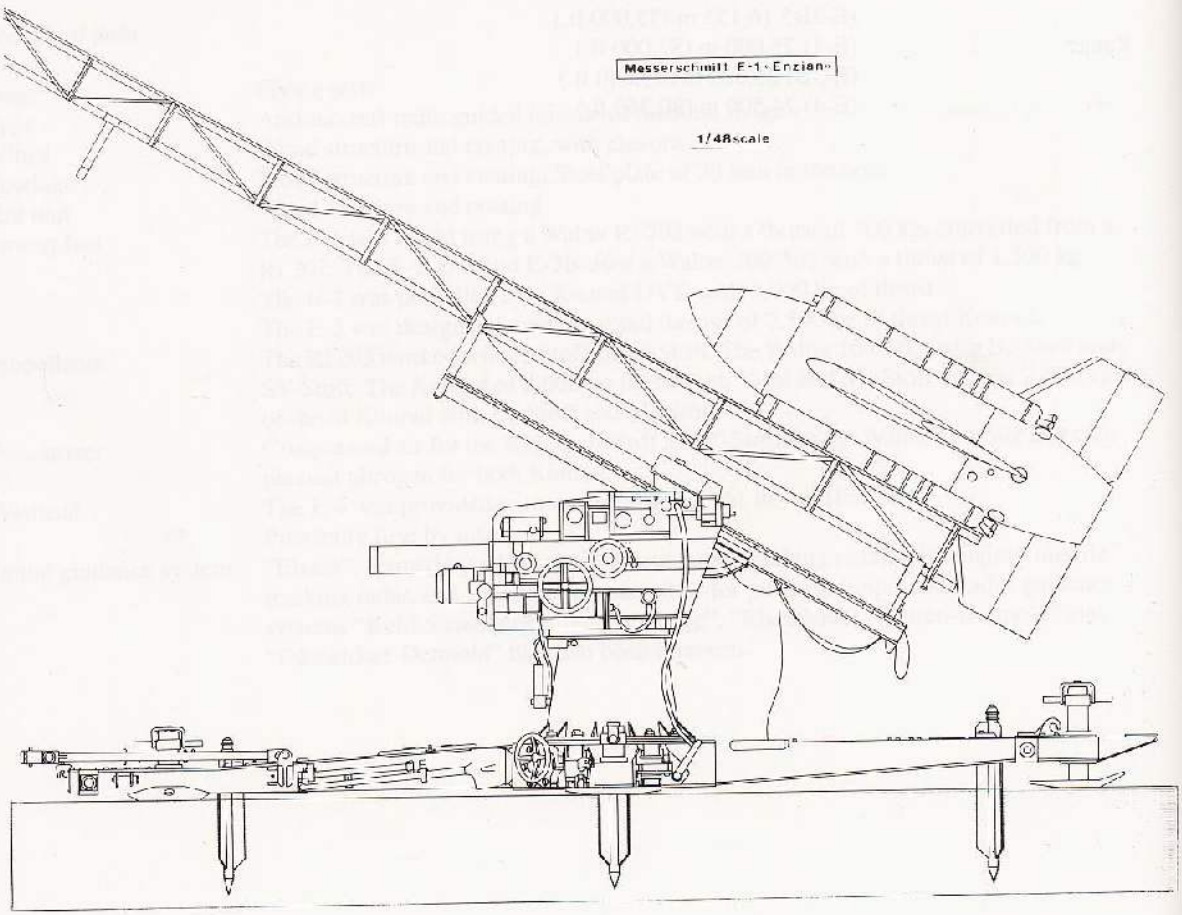
Stage	Flying tests
Type	Anti-aircraft radio guided missile of medium range
Wings	Wood structure and coating, with elevons
Fuselage	Wood structure and coating. Steel plate of 20 mm in the nose
Tail unit	Wood structure and coating
Powerplant	The E-1 was tested using a Walter Ri 202 with a thrust of 500 kg, converted from a Ri 202. The E-2, E-3 and E-3B used a Walter 109-502 with a thrust of 1,500 kg. The E-4 was propelled by a Konrad DVK with 2,000 kg of thrust. The E-5 was designed having in mind the use of 2,500 kg of thrust Konrad.
Propellants	The Ri 203 worked with Z-Stoff and T-Stoff. The Walter 109-502, with Br-Stoff and SV-Stoff. The Konrad of 2,000 kg thrust with Visol and SV-Stoff and the 2,500 kg of thrust Konrad with Br-Stoff and SV-Stoff.
Pressurizer	Compressed air for the Ri 202, T-Stoff and Z-Stoff for the Walter 109-502 and compressed nitrogen for both Konrad.
Warhead	The E-4 was provided with one of 300 kg (661 lb.) of HE
	Proximity fuse by infrared
Initial guidance system	"Elsass", formed by a Mannheim Riese target tracking radar, a Rheingold missile tracking radar, and a Kehlheim transmitter for guidance impulses. Radio guidance systems "Kehl-Strassburg", "Kogge-Brigg", "Rheinland", "Düren-Detmold" and "Düsseldorf-Detmold" had also been foreseen.

Terminal guidance systems	- The infrared system "Madrid", which was tested in flight. - The "Moritz", by semiactive radar - The acoustic "Archimedes"
Length	(E-1) 3,630 mm (11 ft. 10 4/5 in.) (E-3B) 3,500 mm (11 ft. 5 3/4 in.) (E-4) 3,750 mm (12 ft. 3 5/8 in.)
Wingspan	(E-1) 4,050 mm (13 ft. 3 3/8 in.) (E-3B) 4,000 mm (13 ft. 1 1/2 in.) (E-4) 4,050 mm (13 ft. 3 3/8 in.)
Maximum diameter	(E-1) 880 m (2 ft. 10 1/2 in.) (E-3B) 915 mm (3 ft. 1/8 in.) (E-4) 915 mm (3 ft. 1/8 in.)
Launch weight	(E-1) 1,920 kg (4,224 lb.) (E-4 1,800 kg (3,960 lb.)
Maximum speed	(E-1) 925 km/h (514 mph) (E-4) 1,000 km/h (556 mph)
Flying time	(E-1) 69 sec. (E-3B) 65 sec. (E-4) 70 sec.
Effective ceiling	(E-1) 13,500 m (44,280 ft.) (E-3B5 16,155 m (53,000 ft.)
Range	(E-1) 25,000 m (82,000 ft.) (E-3B) 25,500 m (83,640 ft.) (E-4) 24,500 m (80,360 ft.)



Messerschmitt Me 163 "Komet"

1/48 scale



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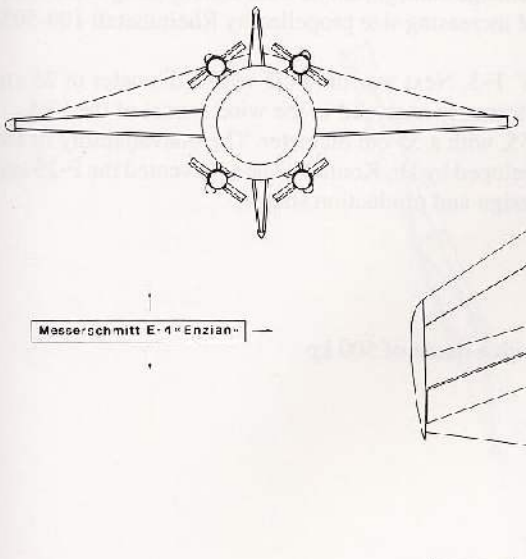
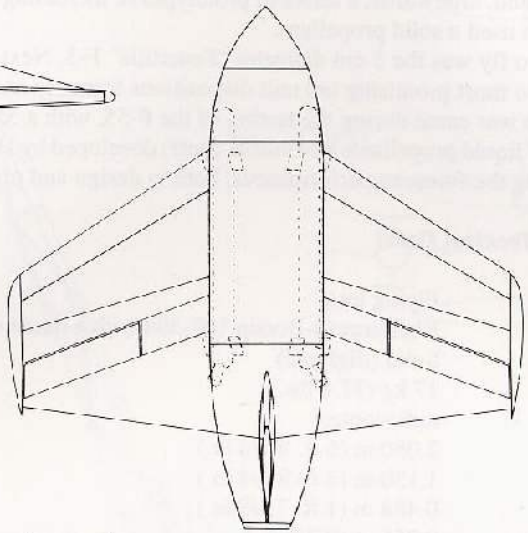
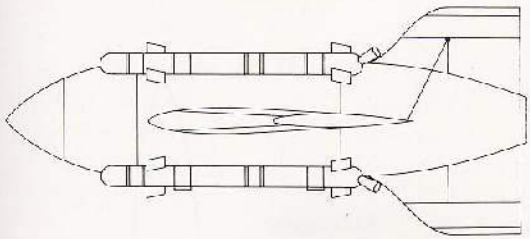
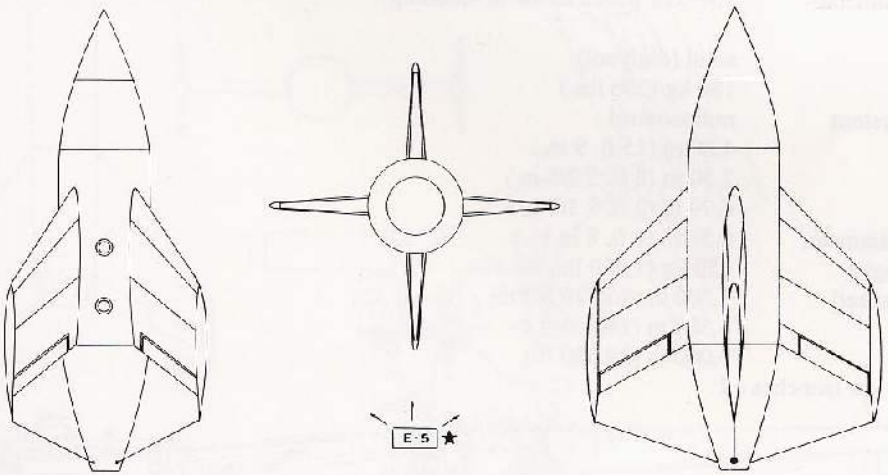


Messerschmitt E-1 "Enzian"







E-5

RHEINMETALL-BORSIG "FEUERLILIE"

Between 1942 and 1945 a brief research program was developed under this name in cooperation with the aerodynamic experts of the LFA. Different wing and empennage configurations were tested, using scale models in a first stage and, afterwards, a series of prototypes of increasing size propelled by Rheinmetall 109-505/515 motors, which used a solid propellant.

The first one to fly was the 5 cm diameter "Feuerlilie" F-5. Next was the F-25 with a diameter of 25 cm used to test the two most promising tail unit dispositions formerly analyzed in the wind tunnel of the LFA.

The end of the war came during the testing of the F-55, with a 55 cm diameter. The unavailability of the powerful motor of liquid propellants (R-Stoff/S-Stoff) developed by Dr. Konrad's team prevented the F-25 and F-55 from reaching the foreseen performances, both in design and production stages.

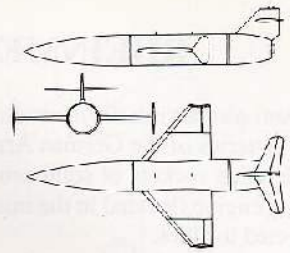
Feuerlilie F-25 (Tecnical Data)

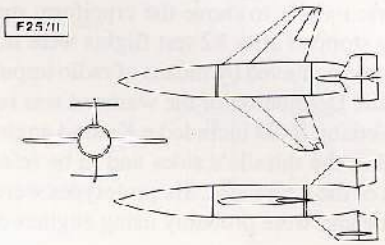
Stage	Flying tests
Motor	Rheinmetall-Borsig 109-505 with a thrust of 500 kp
Propellants	Solid (diglycol)
Warhead	17 kg (37.4 lbs.)
Guidance system	radiocontrol
Length	2.080 m (6 ft. 9 7/8 in.)
Span	1.150 m (3 ft. 9 1/4 in.)
Height	0.488 m (1 ft. 7 3/8 in.)
Maximum diameter	0.255 m (9 7/8 in.)
Launch weight	120 kg (264 lbs.)
Maximum speed	820 km/h (443 MPH)
Range	5,500 m (18,040 ft.)
Ceiling	3,000 m (9,840 ft.)
Number of test launches	30

Feuerlilie F-55 (Technical Data)

Stage	Flying tests
Motor Rheinmetall-Borsig	109-515 with a thrust of 4,000 kp
Propellants	solid (diglycol)
Warhead	180 kg (396 lbs.)
Guidance system	radiocontrol
Length	4.80 m (15 ft. 9 in.)
Span	2.50 m (8 ft. 2 2/5 in.)
Height	0.79 m (2 ft. 7 1/8 in.)
Maximum diameter	0.51 m (1 ft. 8 in.)
Launch weight	650 kg (1,430 lbs.)
Maximum speed	1,500 km/h (810 MPH)
Range	7,500 m (24,600 ft.)
Ceiling	9,000 m (29,520 ft.)
Number of test launches	2

1/48 scale





RHEINMETALL-BORSIG "RHEINTOCHTER"

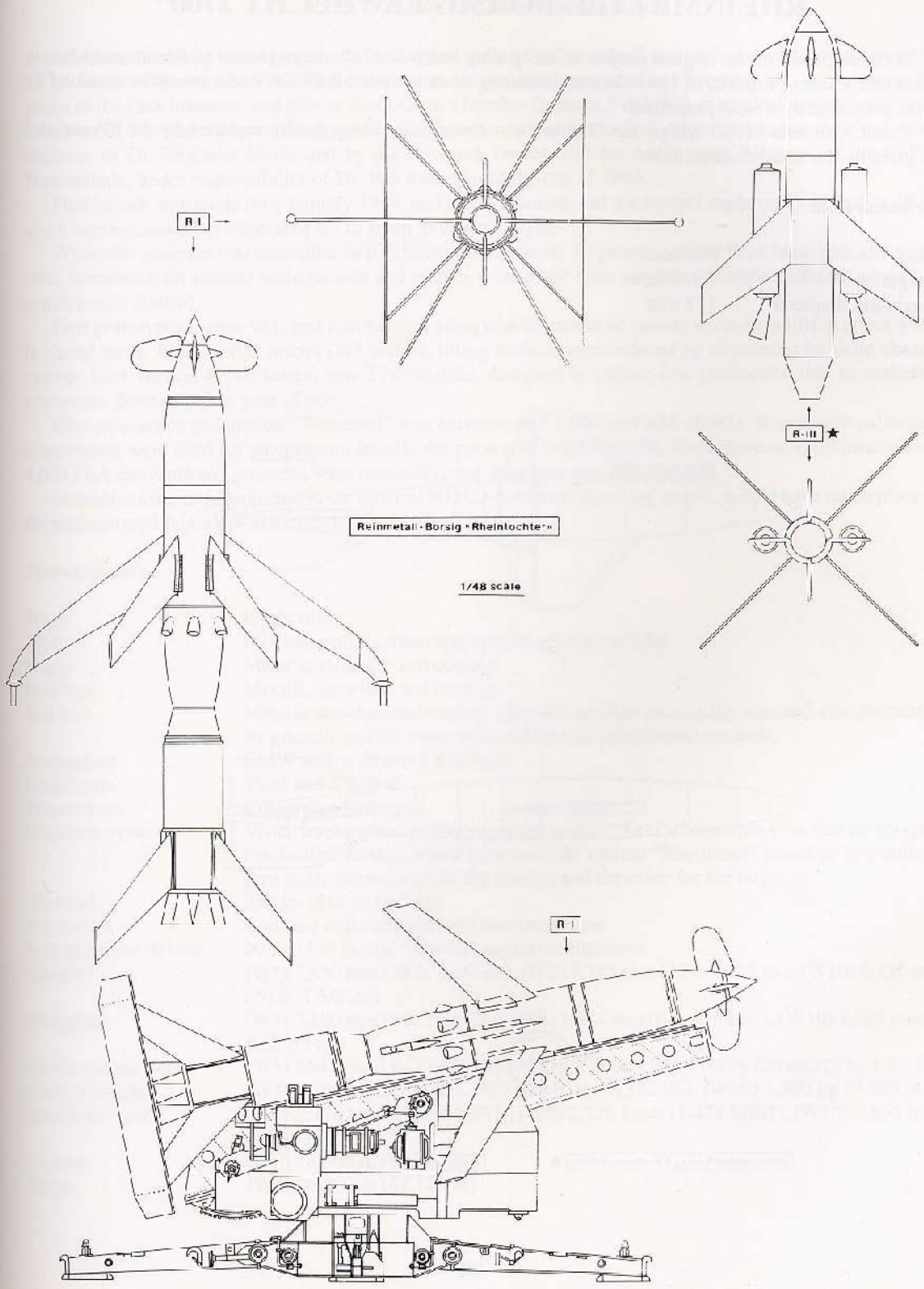
Anti-aircraft missile of revolutionary characteristics which was ordered in November 1942 to reinforce the Flak batteries of the German Army. It took off from a converted mounting of 88 mm aided by a battery of 6 accelerating rockets of solid propellant. The first stage was released when reaching cruise speed. Then, the second engine (located in the missile's centre of gravity) was automatically started, with six nozzles obliquely projected to sides.

The rear section housed the warhead, and the front section contained the guidance mechanism and the electric motors to move the cruciform rudders of the nose. The missile was designated R-I, its manufacture being stopped after 82 test flights were made between August 1943 and December 1944. Flight control from land was achieved by means of radio impulses. Flares located at the wingtips allowed the operator to follow the missile. Detonation of the warhead was remotely actuated from land using codified radio impulses.

Version R-III included a Konrad engine of liquid propellant and only two accelerators of solid propellant, fitted to the missile's sides and to be released in flight. The R-III was to be used in the anti-aircraft defense units of the Luftwaffe. Six prototypes were tested until December 1944, although they did not have the Konrad engine and were probably using engines of solid propellant only.

Technical data

Stage	Flying tests
Type	Medium range antiaircraft missile.
Wings	Wood structure
Fuselage	Structure and coating of light alloy
Canard Empennage	Wood structure with electromechanic controls
Powerplant	(R-I) An acceleration stage, to be released in flight, formed by six engines of solid propellant with a unit thrust of 1,250 kg. Upper stage engine started afterwards. It was formed by six lateral nozzles, had a thrust of 4,000 kg and used solid propellant, too (R-III). An acceleration stage formed by two releasable engines of solid propellant with a thrust of 7,000 kg each and a cruising Konrad engine of liquid propellant with a thrust of 2,180 kg.
Propellants	Diglycol as solid propellant and Visol and SV-Stoff for the Konrad engine.
Pressurizers	Pressurized nitrogen for the Konrad engine of the R-III.
Warhead	(R-I) 150 kg (330 lb.) of HE, behind the engine. (R-III) 100 kg (220 lb.) of HE
Guidance system	radiocontrol, optical tracking and convergent radar beams.
Length	(R-I) 6,288 mm (20 ft. 7 1/2 in), (R-III) 3,744 mm (12 ft. 3 1/4 in.)
Wingspan	(R-I) 3,792 mm (12 ft. 5 1/8 in.), (R-III) 2,928 mm (9 ft. 7 in.)
Maximum diameter	(R-I) 576 mm (1 ft. 10 4/5 in.), (R-III) 470 mm (1 ft. 6 1/2 in.)
Launch weight	(R-I) 1,750 kg (3,750 lb.), (R-III) 1,500 kg (3,300 lb.)
Useful ceiling	(R-I) 7,000 m (22,960 ft.), (R-III) 15,000 m (49,200 ft.)
Range	(R-I) 40 km (21,6 NM)
Maximum speed	(R-I) 1,296 km/h (699 MPH), (R-III) 1.080 km/h (583 MPH)


R I
R-III
Rheintochter
1/48 scale
R I

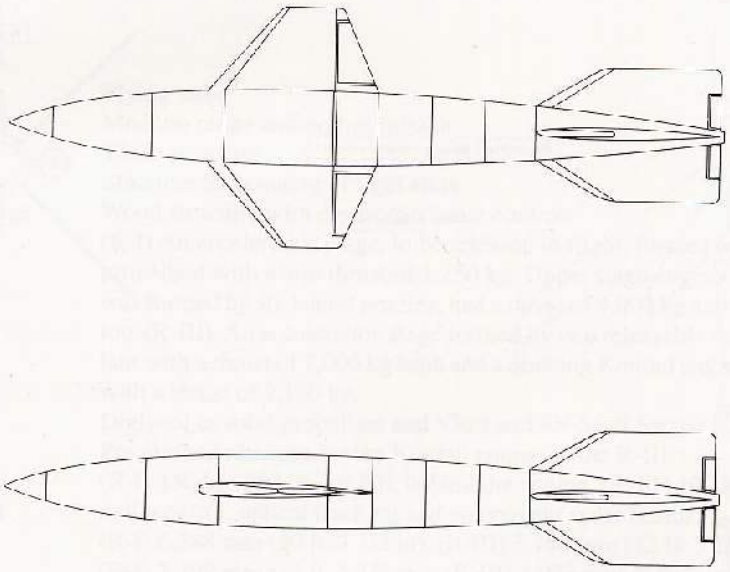
RHEINMETALL-BORSIG FK "HECHT 2700"

A development of the original project of the gliding bomb K-1750, the engineers of Rheinmetall-Borsig Klein and Vüllers proposed in 1941 the manufacturing of an antiaircraft rocket, under the denomination FK-2700, propelled by a solid propellant.

Fitted with able-to-roll wings, the "Hecht" was never built, being finally replaced by the "Feuerlilie" program by the same manufacturer.

Technical Data

Span	588 mm
Length	1,750 mm
Maximum diameter	177 mm



Rheinmetall-Borsig FK "Hecht 2700" ★ 1/15 scale

EMW C2 "WASSERFALL"

Antiaircraft missile based on same technology as the A4 (V-2) was built to satisfy a specification issued by the RLM on 18 September 1942. This order requested the development of guided rockets to complement the action of the Flak batteries, and able to shoot down a bomber flying at 540 MPH, at an altitude of 12 miles and a distance of 30 miles. Research and development was carried out by the Flak-Versuchskommando Nord under direction of Dr. Engineer Haase and by the Research Department for Antiaircraft Weapons of the EMW-Peenemünde, under responsibility of Dr. Von Braun, until the end of 1943.

First launch was made on 8 January 1944, and it was a failure, but the second made on 29 February 1944, was a success, reaching a speed of 2,772 km/h in vertical flight.

When this program was cancelled on 6 February 1945, nearly 40 prototypes had been launched, and many other launches with smaller scale rockets and models were made from airplanes to study different aspects of aerodynamic control.

First prototypes (series W1) had four big fins alongside the centre of gravity to create a lifting effect when in closed turns. In the series model (W5 series), lifting surface were reduced by improving its radio control system. Last version (W10 series) was 27% smaller, designed to reduce cost-production due to materials scarceness during the last year of war.

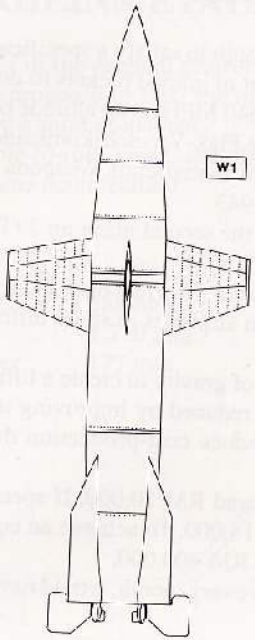
Cost of a series production "Wasserfal" was between RM 7,000 and RM 10,000. If specially calibrated components were used for an optimum launch, the price rose to RM 14,000. To achieve an equivalent result, 4,000 FLA conventional grenades were necessary, and their cost was RM 400,000.

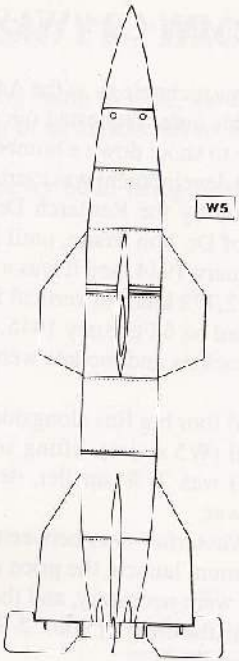
Manufacturing rate, projected in the order of 900 C2-8/45 missiles every month, would have taken place in the underground factory of Bleichrode.

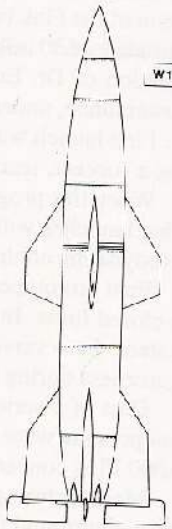
Technical data

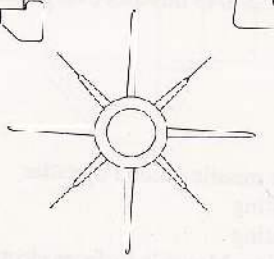
Stage	Flight test
Type	Medium range antiaircraft missile guided by radar
Wings	Metallic structure and coating
Fuselage	Metallic structure and coating
Tail unit	Metallic structure and coating. Movable surfaces electrically actuated, complemented by graphite nozzle vanes actioned by electrohydraulic controls.
Powerplant	EMW with a thrust of 8,000 kg
Propellants	Visol and SV-Stoff
Pressurizers	Compressed nitrogen
Guidance system	Visual tracking and radio-controlled system "Kehl"/"Strassburg" in first prototypes. Production version would have used the system "Rheinland" based on two conver gent radar beams, one for the missile and the other for the target.
Warhead	235 kg (516 lb.) of HE
Detonators	Codified radio impulse and proximity fuse
Self-destroyer device	90 kg (198 lb.) of "Nipolit" explosive filaments
Length	(W1) 7,450 mm (24 ft. 5 1/4 in.), (W5) 7,765 mm (25 ft. 5 2/5 in.), (W10) 6,128 mm (20 ft. 1 3/8 in.)
Wingspan	(W1) 2,880 mm (9 ft. 5 2/5 in.), (W5) 1,944 mm (6 ft. 4 3/8 in.), (W10) 1,584 mm (5 ft. 2 1/8 in.)
Maximum diameter	(W1) 864 mm (2 ft. 1 in.), (W5) 864 mm (2 ft. 1 in.), (W10) 720 mm (2 ft. 4 3/8 in.)
Launch weight	(W1) 3,500 kg (7,700 lb.), (W5) 3,810 kg (8,382 lb.), (W10) 3,500 kg (7,700 lb.)
Maximum speed	(W1) 2,772 km/h (1,496 MPH), (W5) 2,736 km/h (1,477 MPH), (W10) 2,855 im/h (1,541 MPH)
Ceiling	(W5) 18,300 m (60,390 ft.)
Range	(W5) 26,400 m (87,120 ft.)

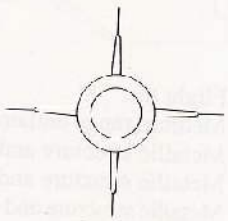
EMW C2 'Wasserfall'

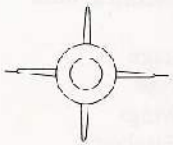


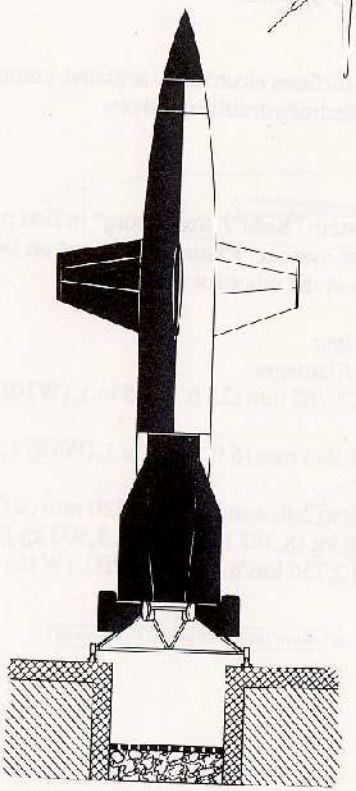


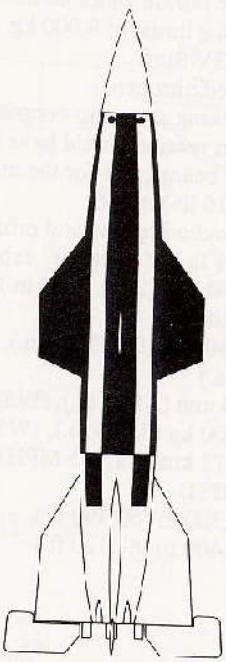












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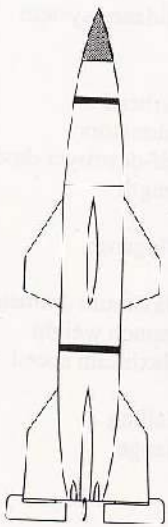
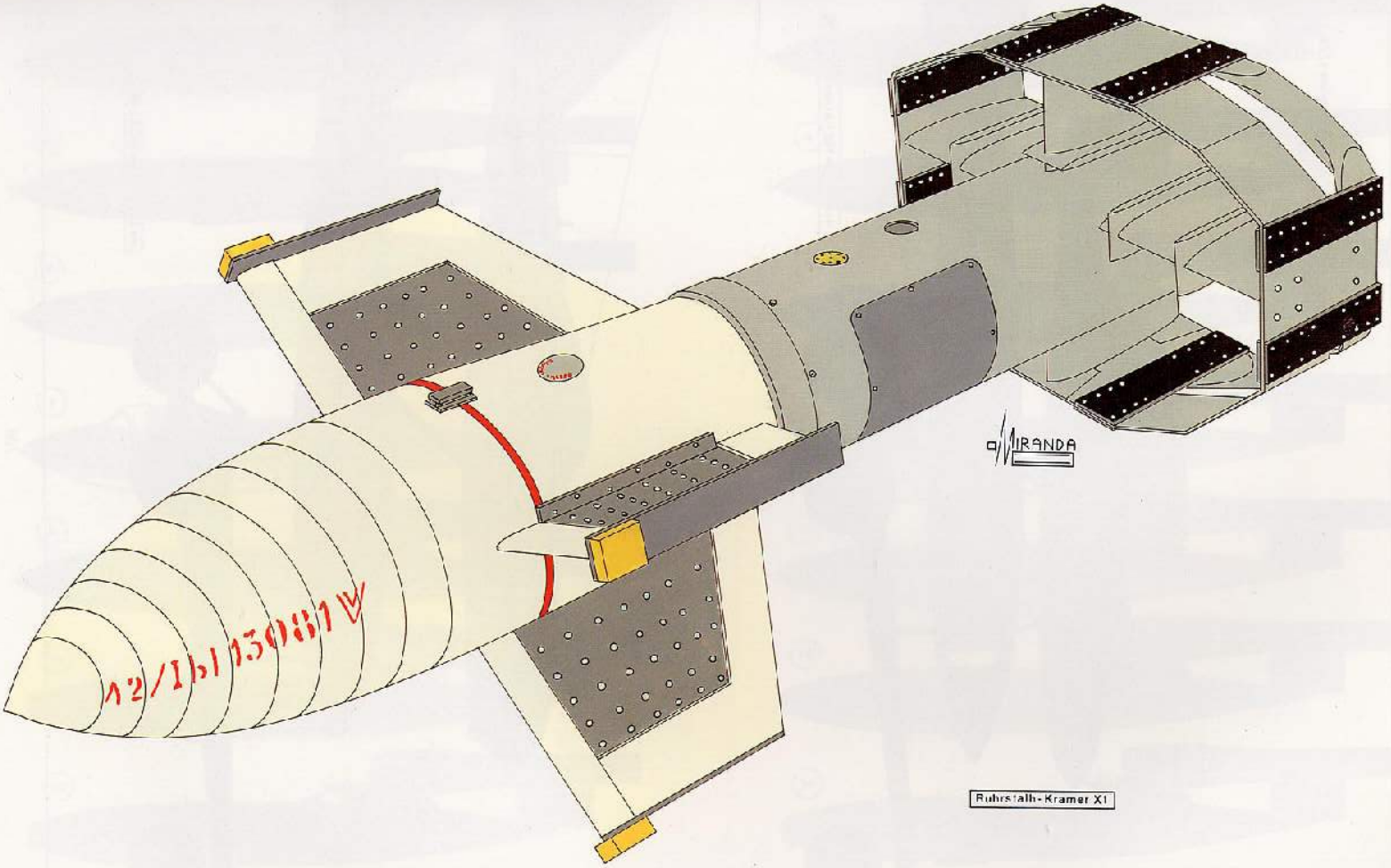
1/72 scale

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12/1b1 130d1 W
Ruhrstahl-Kramer X1

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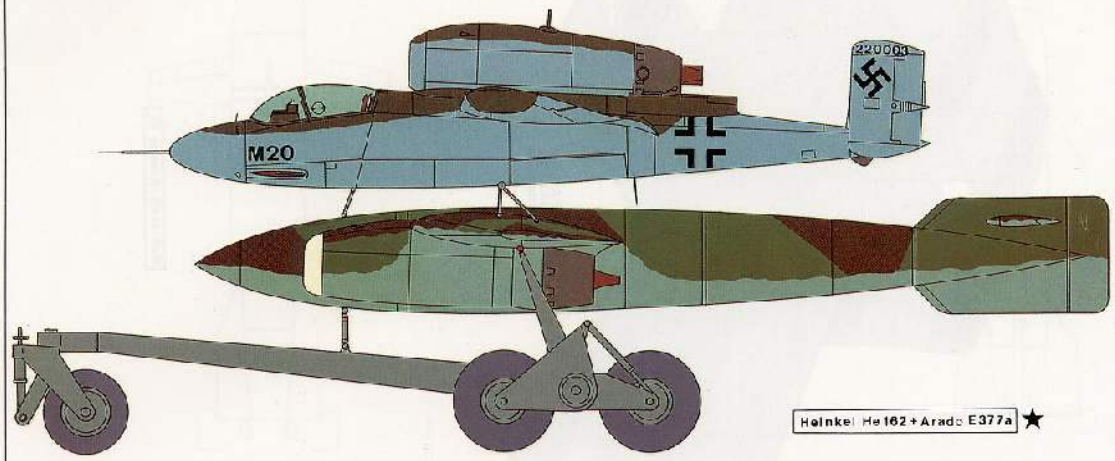
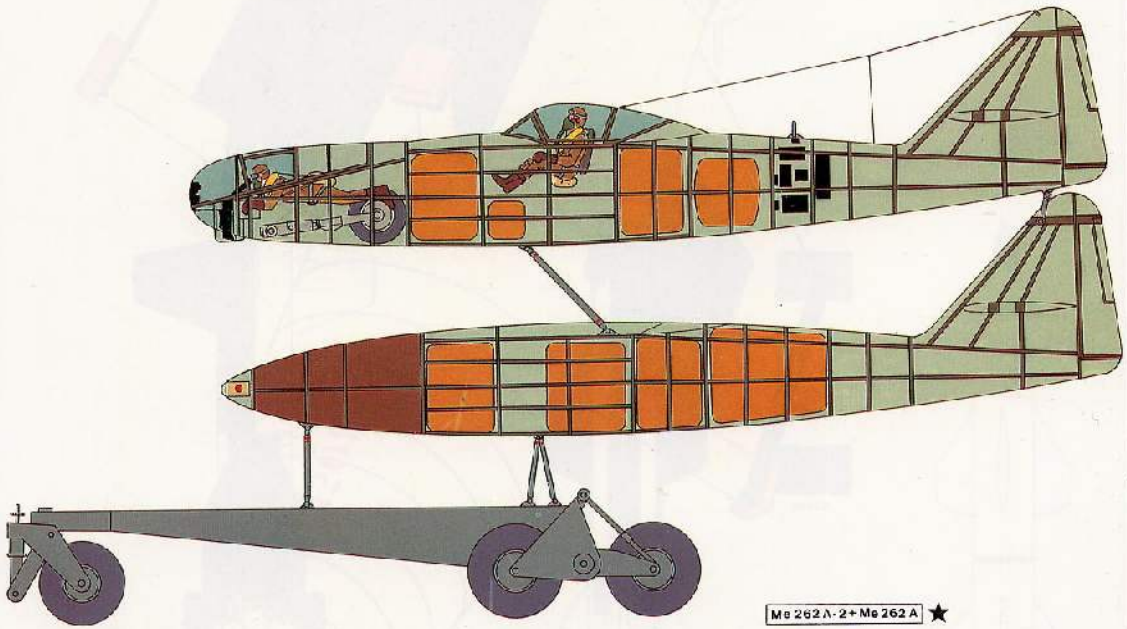
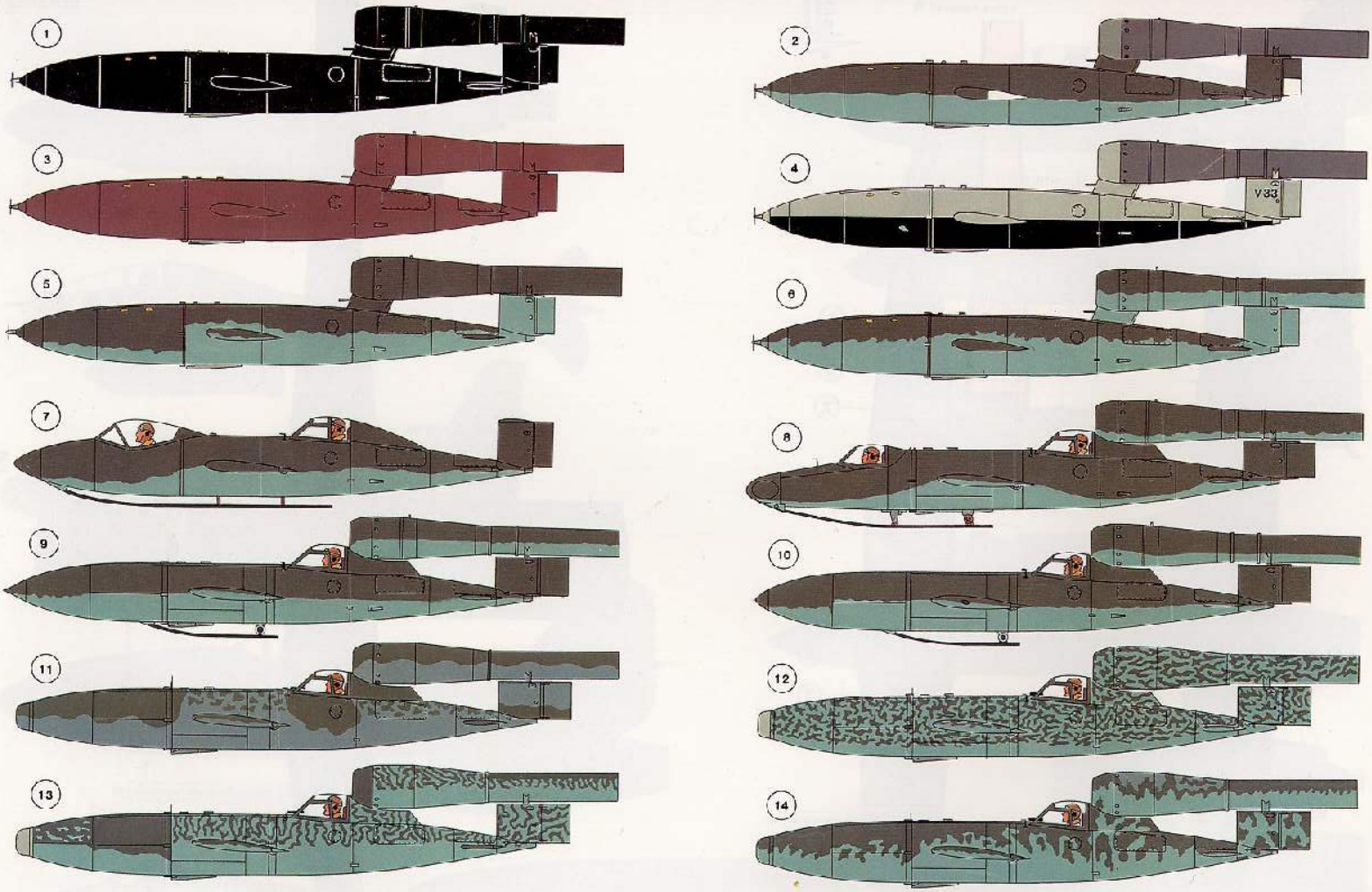


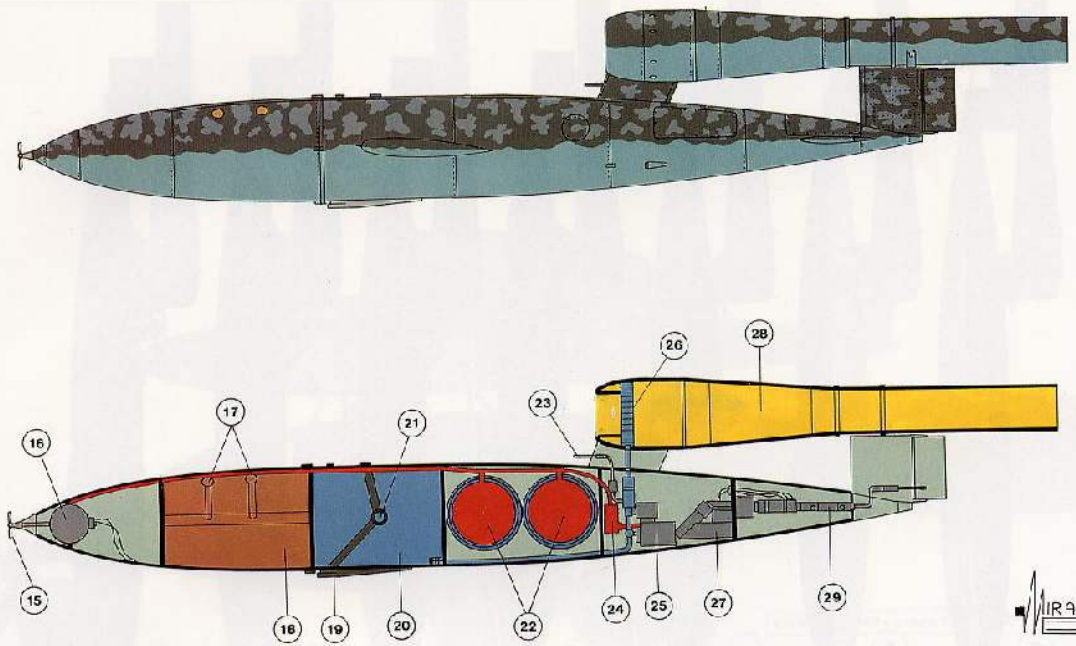
Heinkel He 162 + Arado E377a ★



Me 262 A-2 + Me 262 A ★



scale 1/72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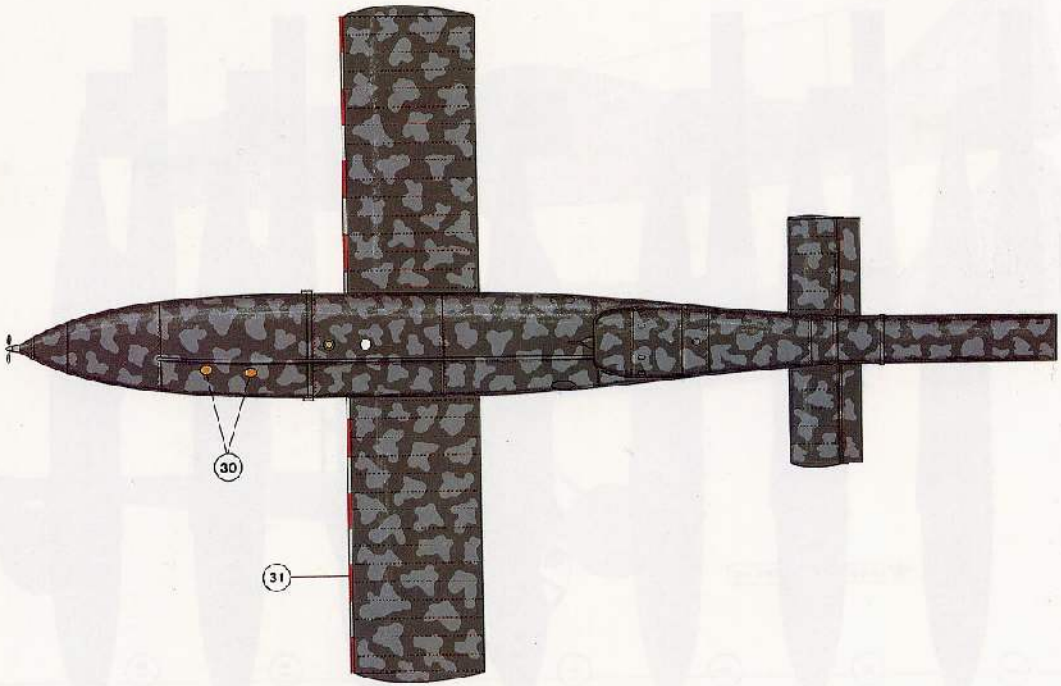
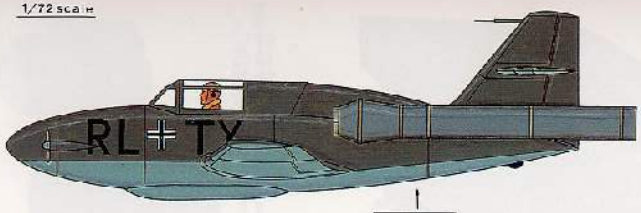
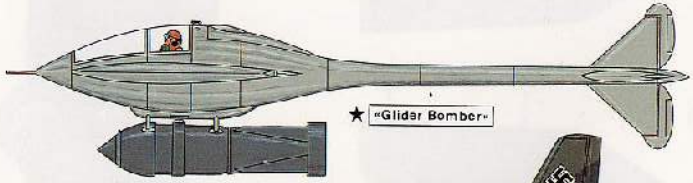
IRANDA


30
31

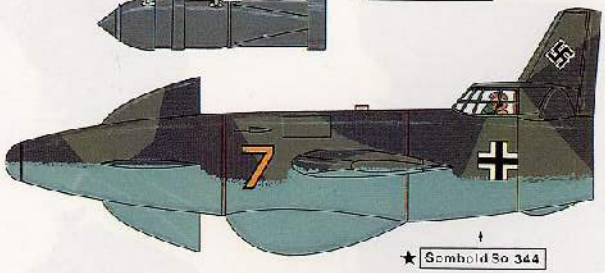
1/72 scale



Me328 A-1



★ «Glider Bomber»



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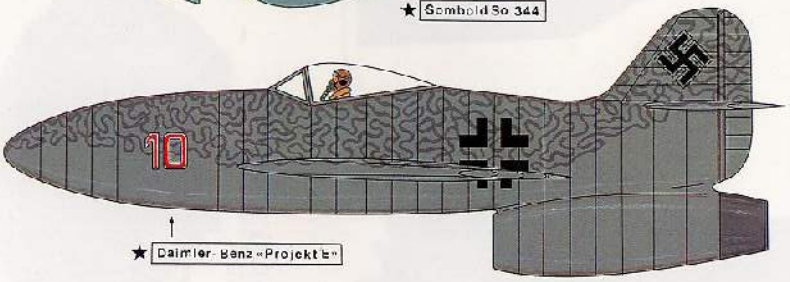
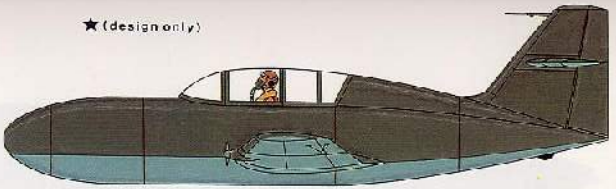


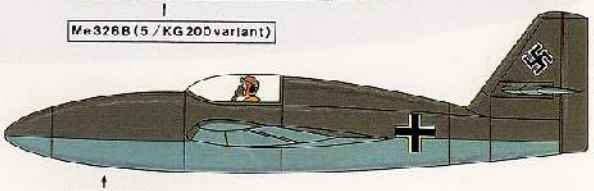
★ Daimler-Benz «Projekt E»

★ Zeppelin «Rammer»

★ (design only)

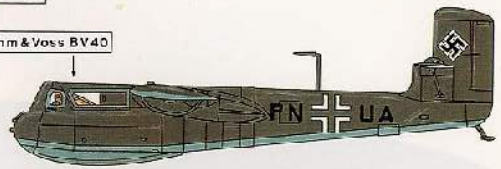


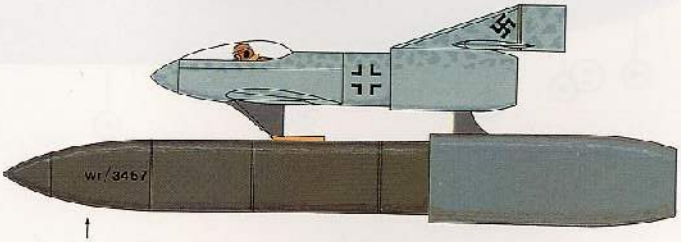
Me328B (5./KG200 variant)



Me328 V1

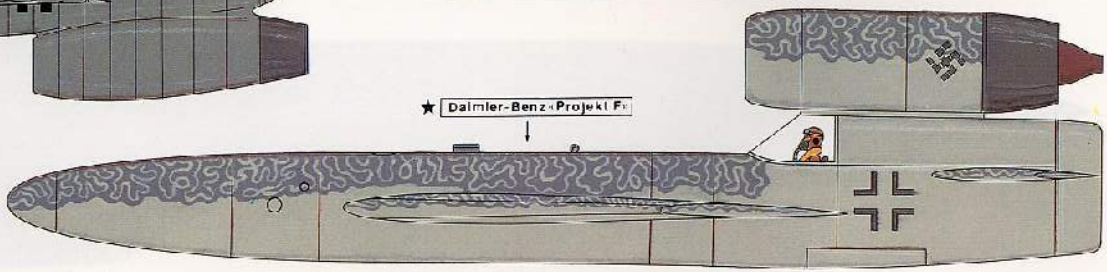
Blohm & Voss BV40

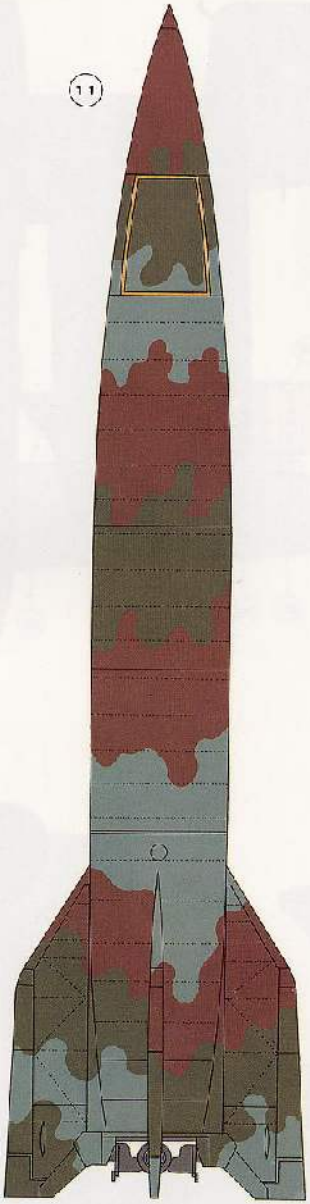


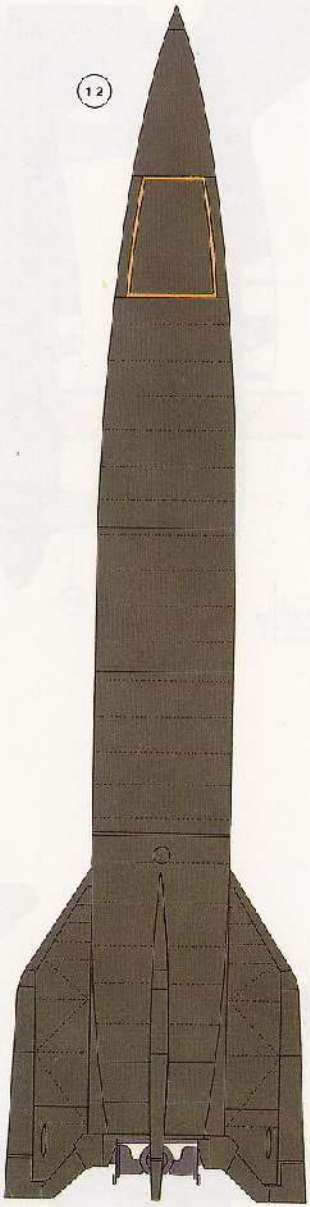


★ Blohm & Voss «Manuell Gesteuertes Raketen Projektil»

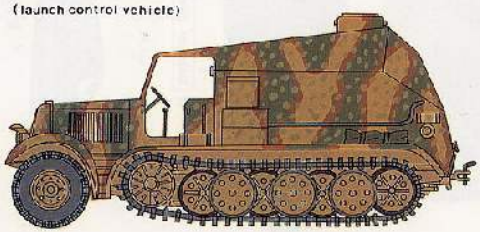
★ Daimler-Benz «Projekt F»



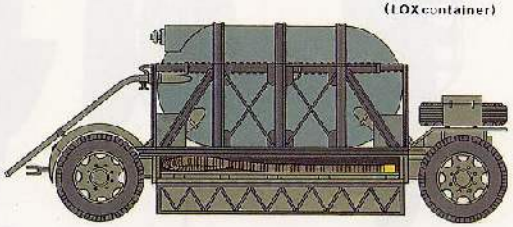


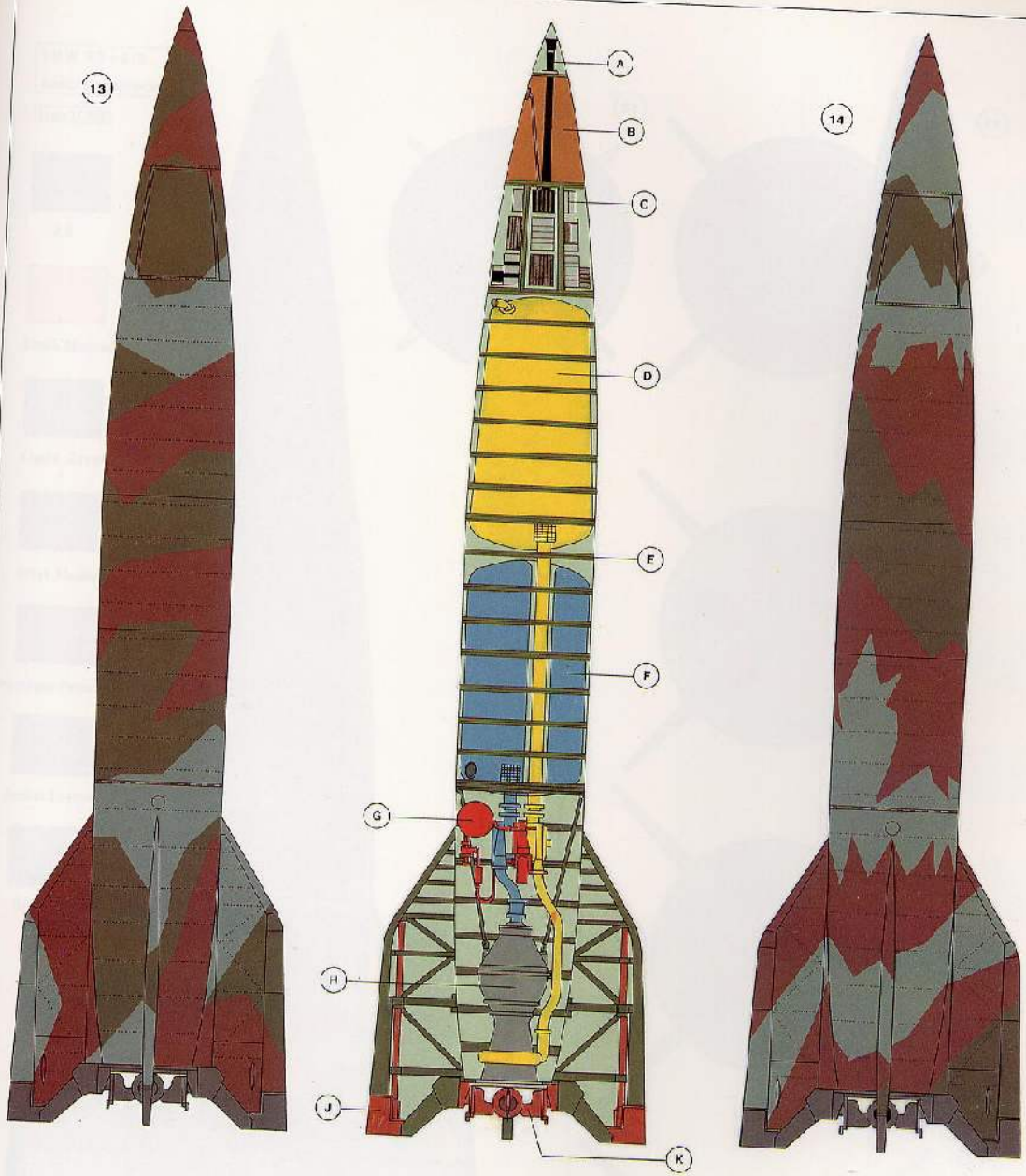


Feuerleitpanzer Sd. Kfz. 7/3
(launch control vehicle)

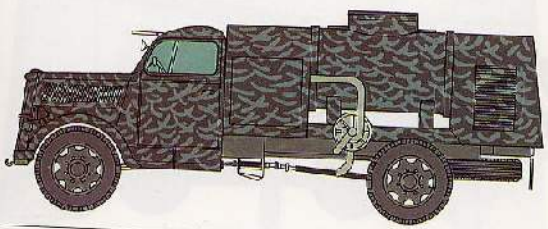


Kesselanhänger für Flüssig-Sauerstoff
(LOX container)

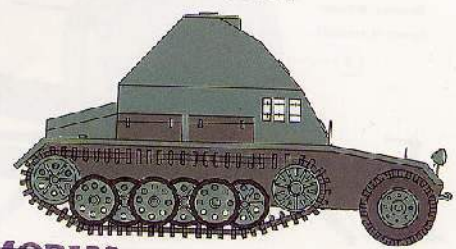


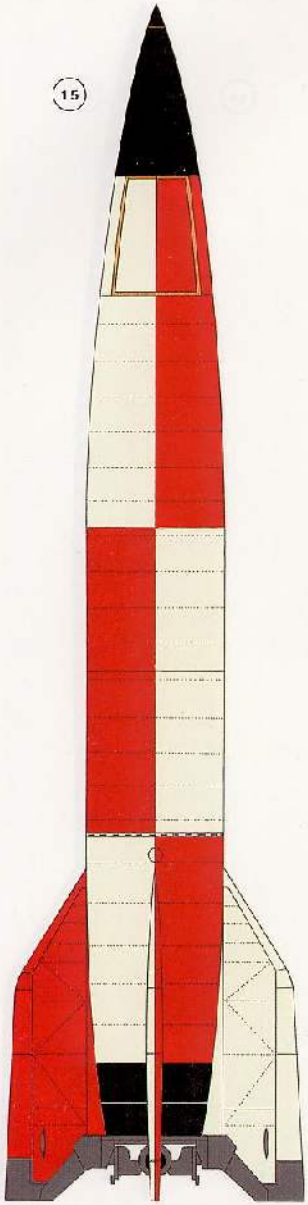


Opel-Blitz T-Stoffwagen
(hydrogen peroxide tanker)



Feuerleitpanzer Sd.Kfz.251
(launch control vehicle)

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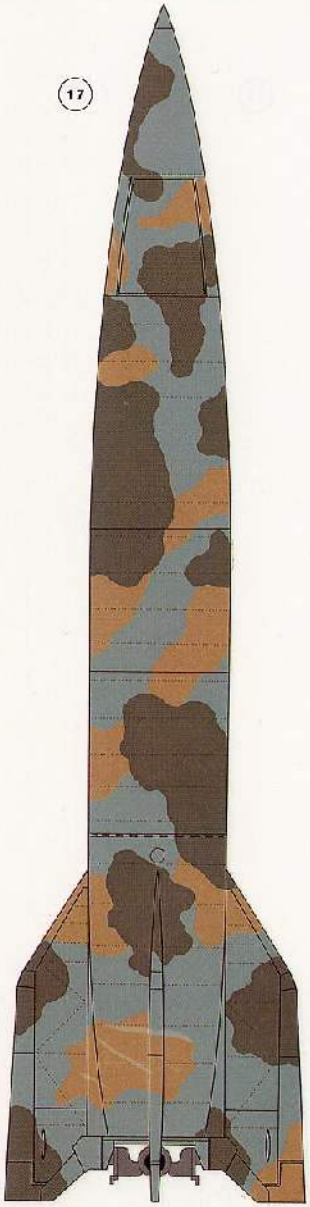
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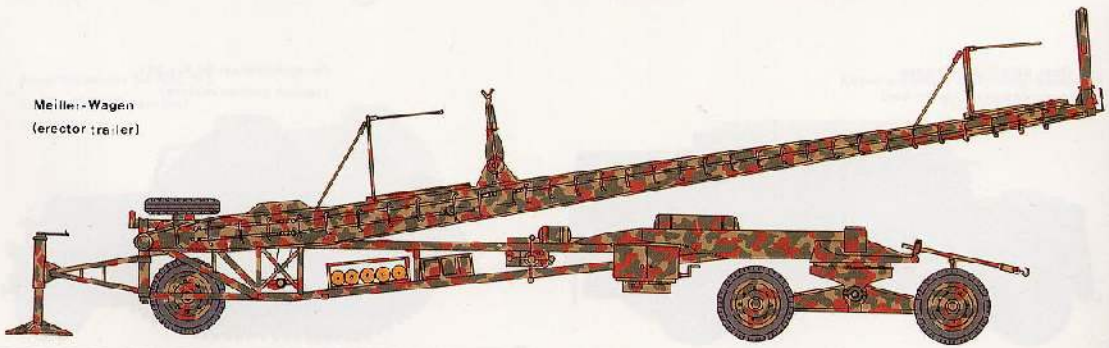
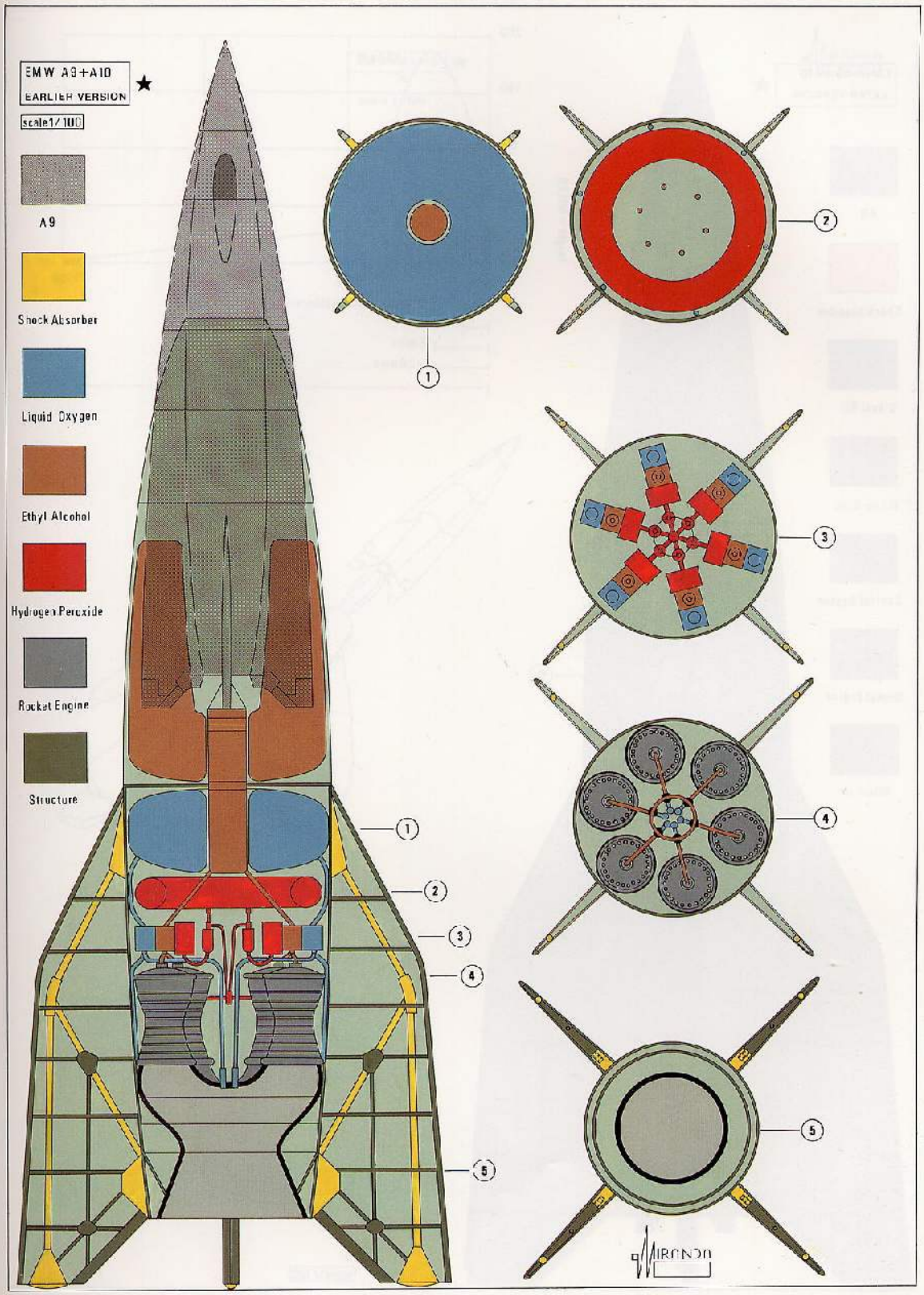
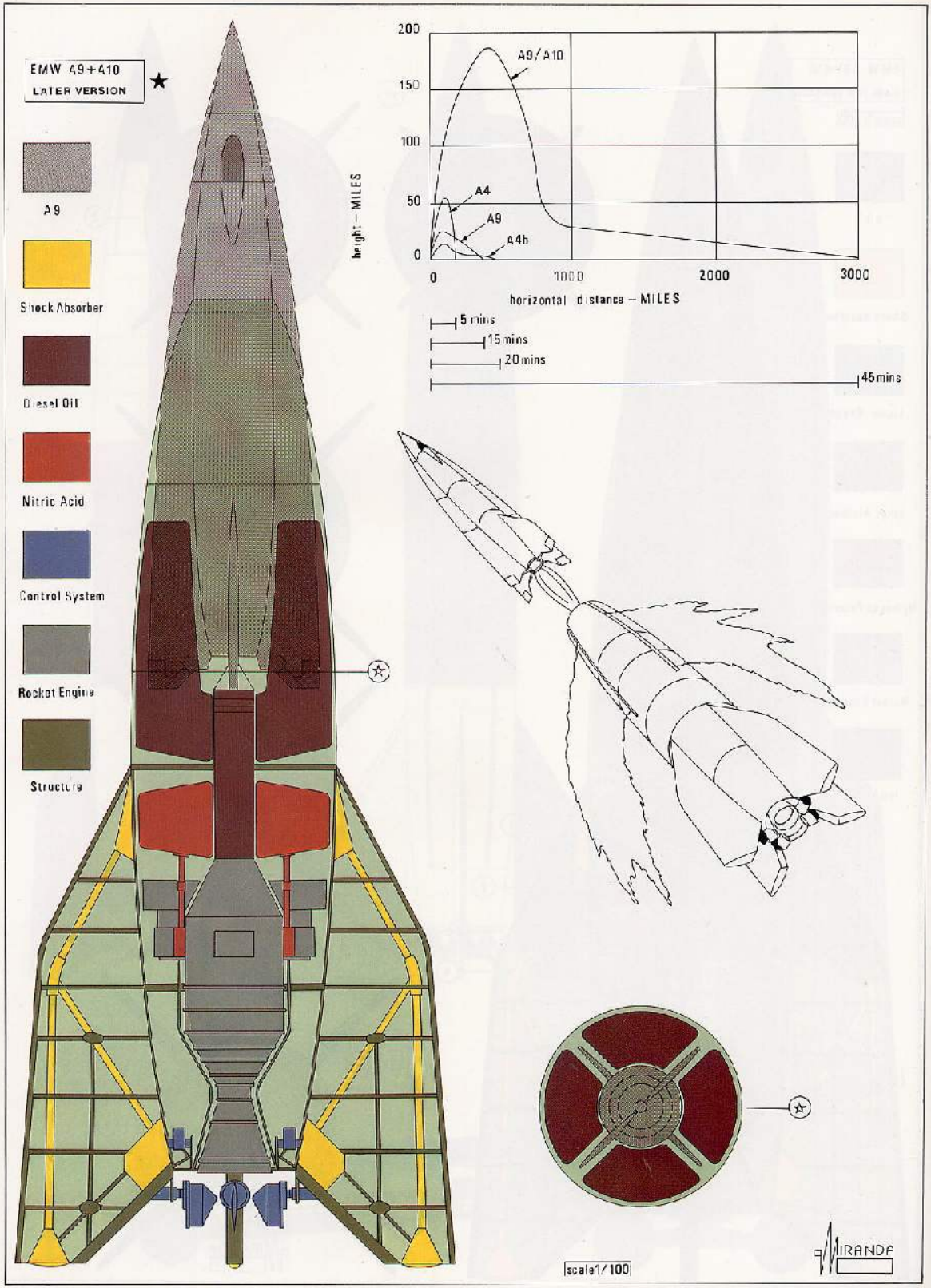

Meiller-Wagen
(erector trailer)

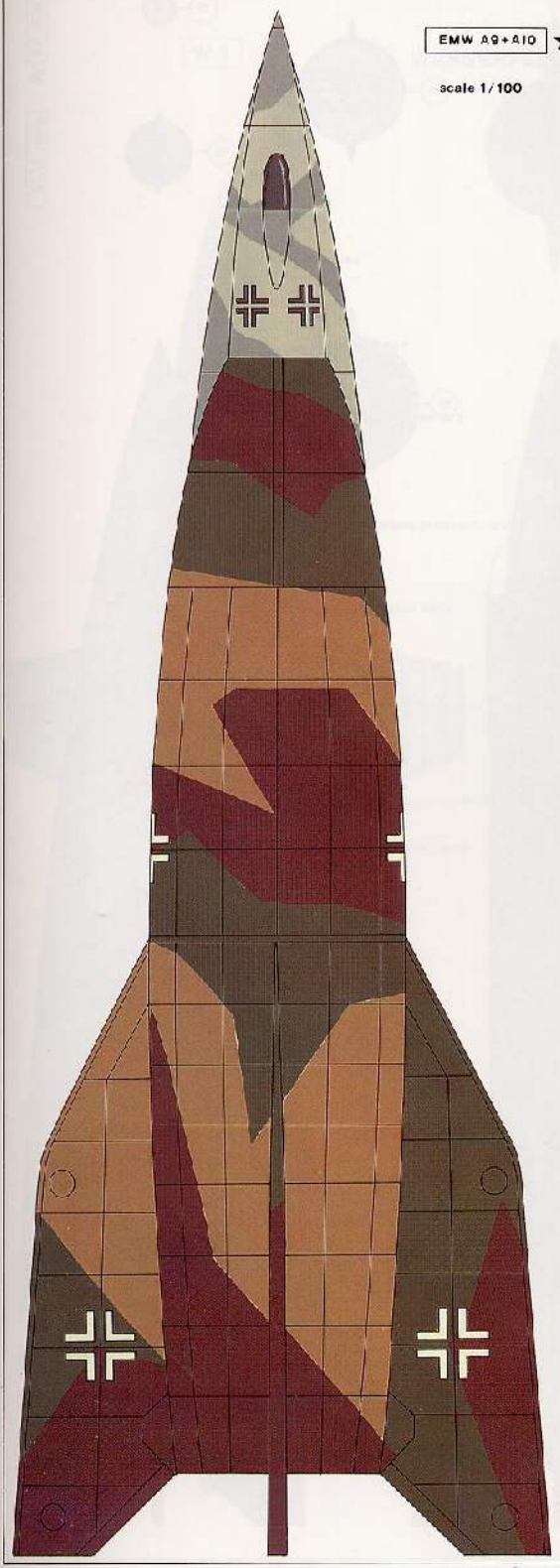

EMW A9+A10
EARLIER VERSION
★
scale1/100
A9
Shock Absorber
Liquid Oxygen
Ethyl Alcohol
Hydrogen Peroxide
Rocket Engine
Structure
1
2
3
4
5
1
2
3
4
5
MIRANDA

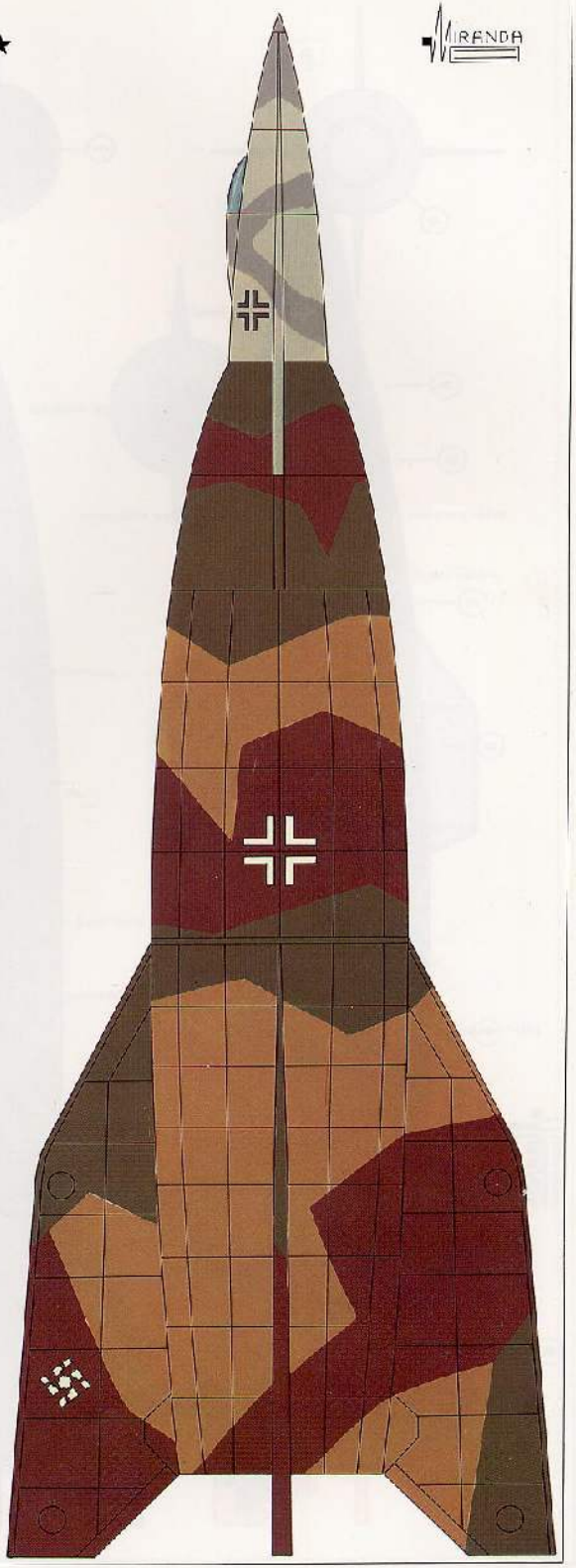

EMW A9+A10
LATER VERSION
A9
Shock Absorber
Diesel Oil
Nitric Acid
Control System
Rocket Engine
Structure
200
150
100
50
0
height – MILES
A9/A10
A4
A9
A4b
0
1000
2000
3000
horizontal distance – MILES
5 mins
15 mins
20 mins
45 mins
scale 1/100
MIRANDE

EMW A9+A10 ★

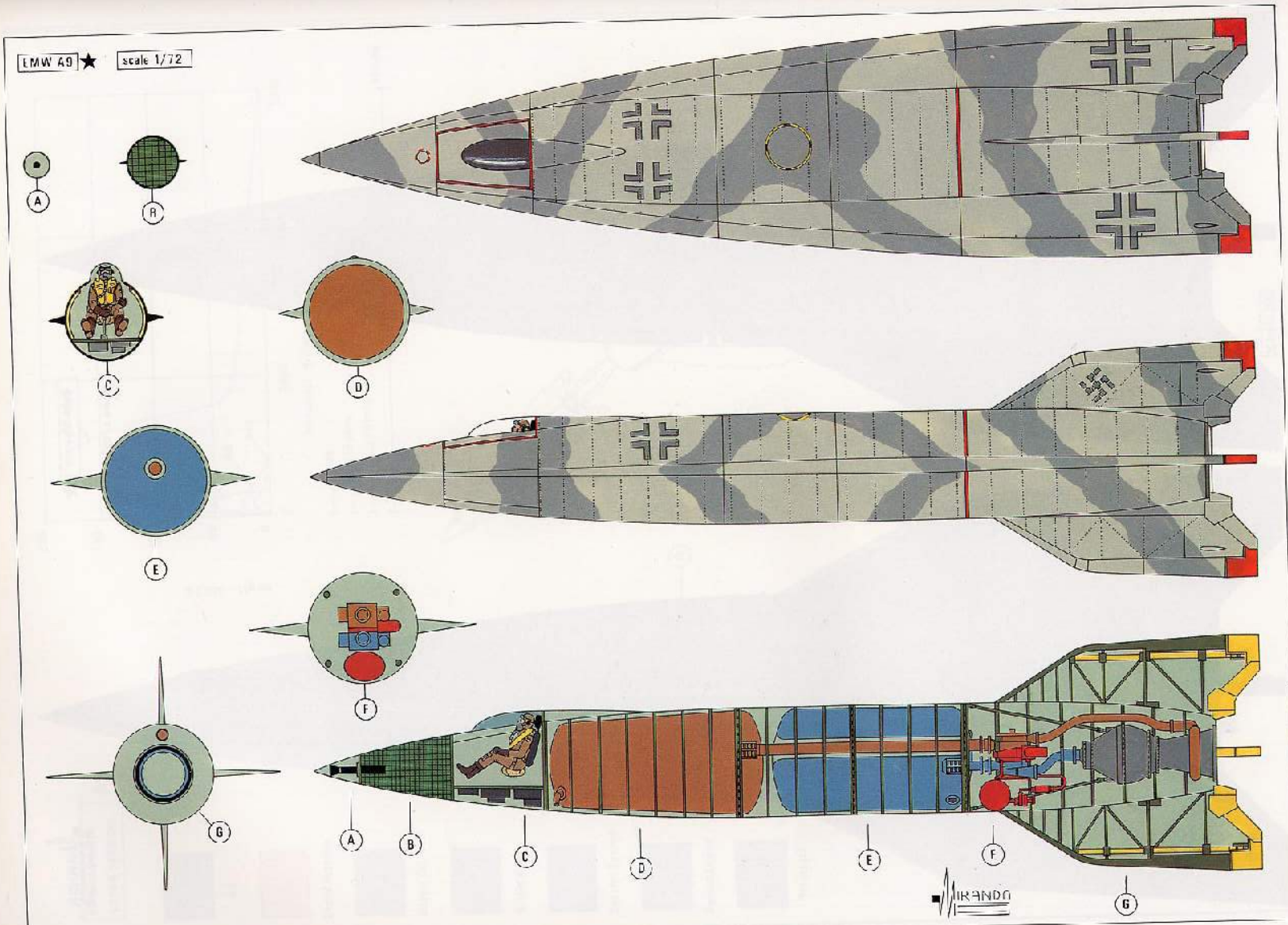
scale 1/100

MIRANDA





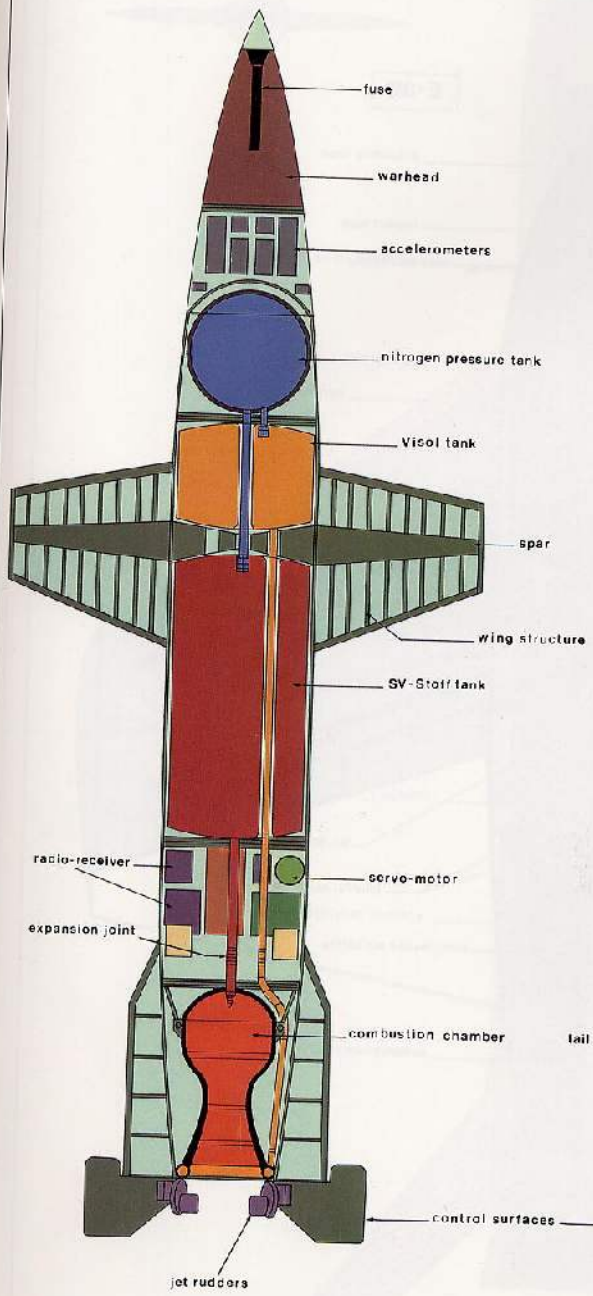
EMW A9 ★ scale 1/72

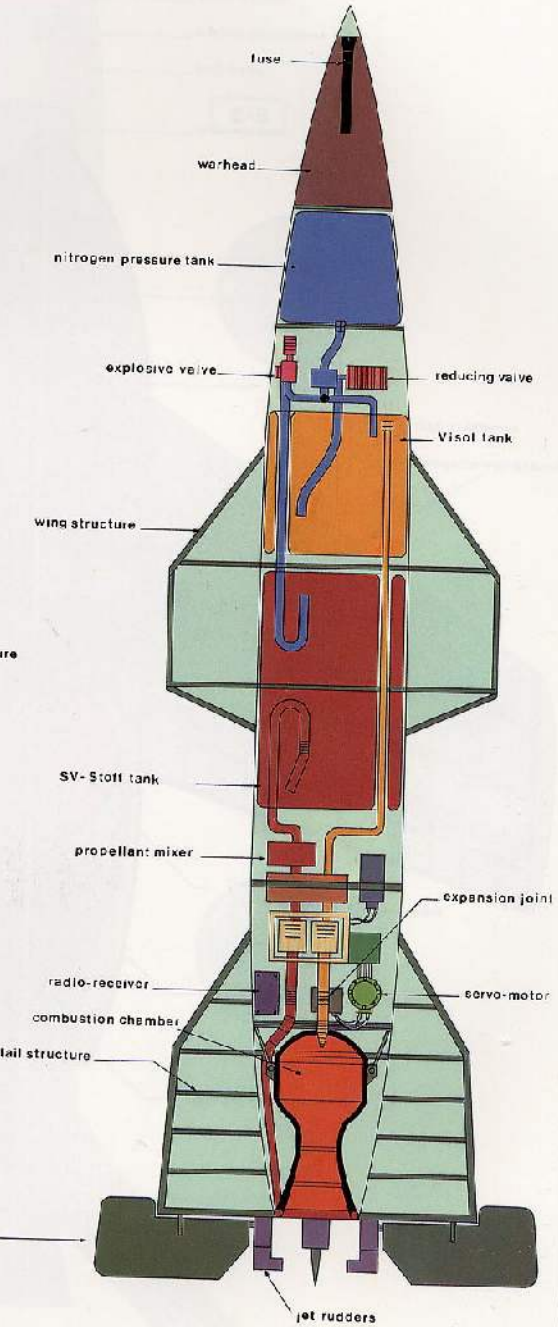


W 1

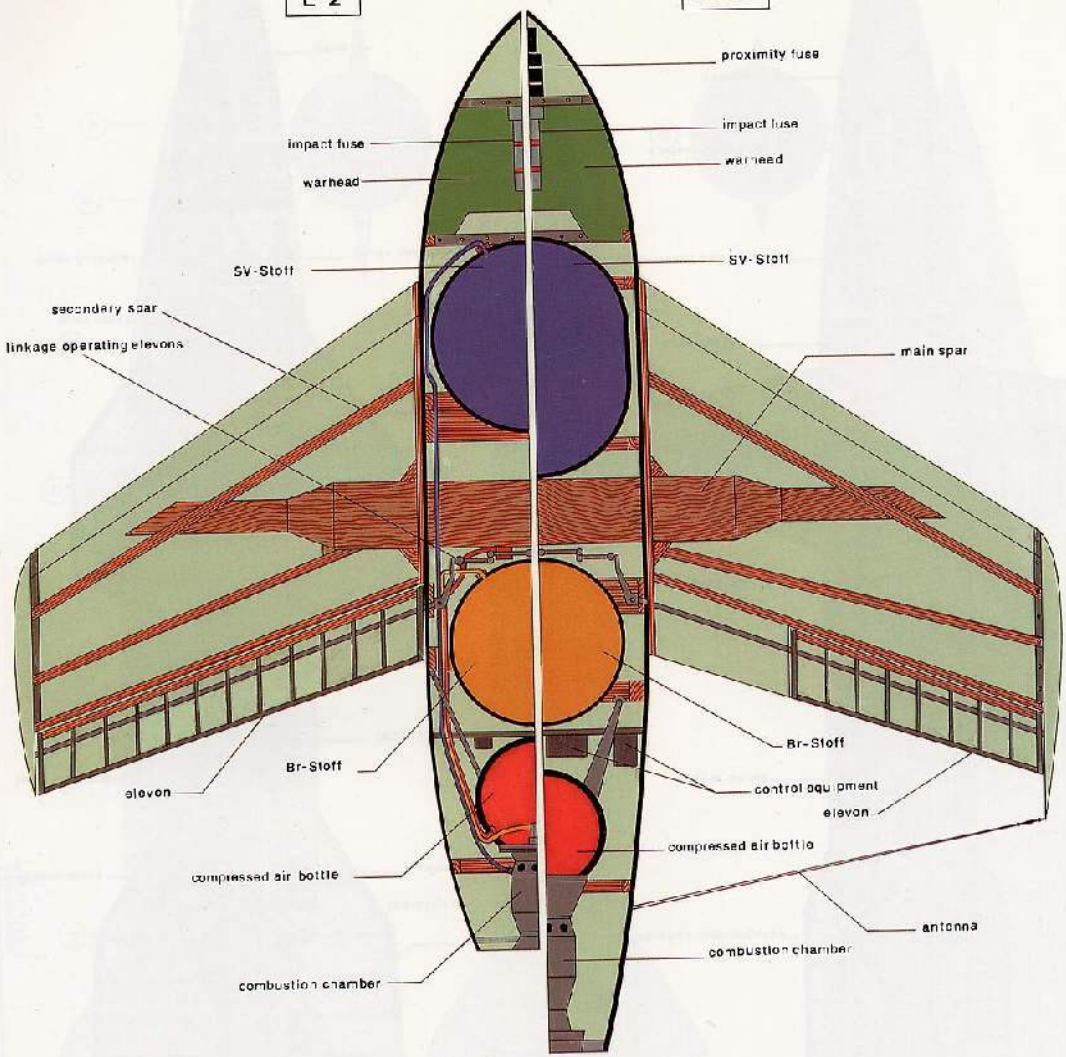
WASSERFALL

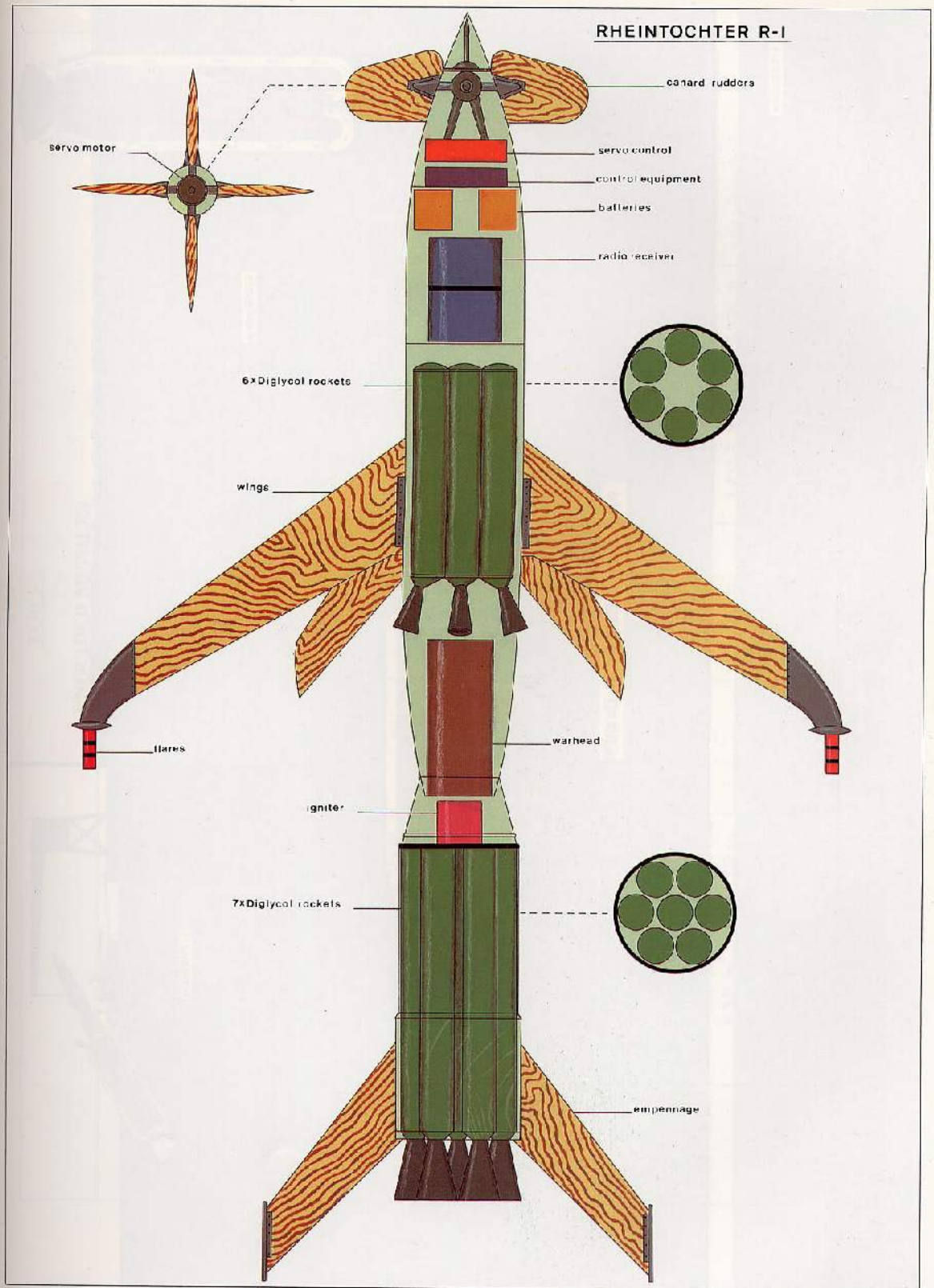
W 5





ENZIAN


E-2
E-3B
proximity fuse
impact fuse
warhead
impact fuse
warhead
SV-Stoff
SV-Stoff
secondary spar
linkage operating elevons
main spar
Br-Stoff
control equipment
elevon
elevon
Br-Stoff
compressed air bottle
compressed air bottle
antenna
combustion chamber
combustion chamber


RHEINTOCHTER R-I
canard rudders
servo motor
servo control
control equipment
batteries
radio receiver
6x Diglycol rockets
wings
flares
warhead
igniter
7x Diglycol rockets
empennage

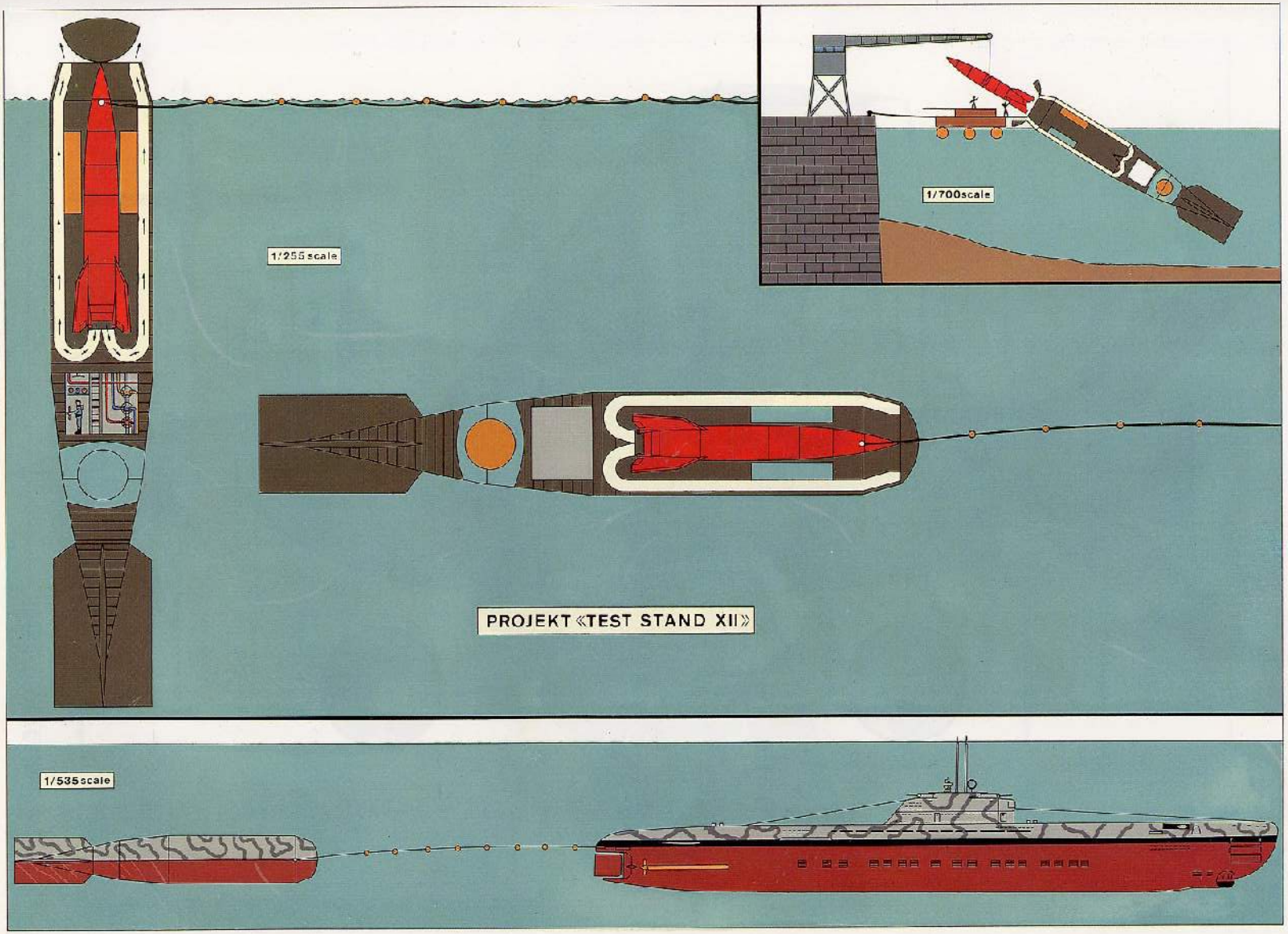

1/700 scale
1/255 scale
PROJEKT «TEST STAND XII»
1/535 scale

TABLE 1

UNGUIDED MISSILES

	LENGTH	DIAMETER	WIN.GSPAN	TOTAL WEIGHT	MAX. SPEED	RANGE	COMMENTS
RZ 65	262 mm	73 mm	-	2.780 kg	260 m/seg	250 m	Experimental, air to air
	10 3/8 in.	2 7/8 in.	-	6.116 lb	852.8 ft./sec.	820 ft.	
RZ 7	330 mm	73 mm	-	3.167 kg	360 m/seg	400 m	Experimental, air to air
	1 ft. 1 in.	2 7/8 in.	-	6.967 lb	1,180.8 ft./sec.	1,312 ft.	
RZ100	1,650 mm	420 mm	-	730 kg	-	-	Experimental, air toground
	5 ft. 4 7/8 in.	1 ft. 4 1/2 in.	-	1,606 lb	-	-	
W.Gr.21	1,177 mm	210 mm	-	111 kg	315 m/seg	2,200 m	Operational air to air
	3 ft. 10 2/5 in.	8 1/4 in.	-	244 lb	1,033.2 ft./sec.	7,216 ft.	
W.Gr.28/32	990 mm	320 mm	-	-	-	1,800 m	Operational air to ground
	3 ft. 2 7/8 in.	1 ft. 5/8 in.	-	-	-	5,904 ft.	(antitank)
R100 BS	1,840 mm	282 mm	320 mm	110 kg	450 m/seg	2,000 m	Experimental air to air,
	6 ft. 3/8 in.	11 in.	1 1/2 in.	242 lb	1,476 ft./sec.	6,560 ft.	automatically fired by radar
Panzerschreck	800 mm	100 mm	230 mm	8 kg	135 m/seg	-	Experimental, air to ground
	2 ft. 7 1/2 in.	4 in.	9 in.	17.6 lb	442.8 ft./sec.	-	(antitank)
Panzerblitz I	705 mm	93 mm	200 mm	6.54 kg	374 m/seg	-	Experimental, air to ground
	2 ft. 3 1/2 in.	3 5/8 in.	8 in.	14.388 lb	1226.7 ft./sec.	-	(antitank)
Panzerblitz II	815 mm	130 mm	-	5.10 kg	370 m/seg	-	Experimental, air to ground
	2 ft. 8 1/4 in.	5 in.	-	11.22 lb	1213.6 ft./sec.	-	(antitank)
R 4/M "Orkan"	812 mm	55 mm	242 mm	3.85 kg	525 m/seg	1,50 m	Operational, air to air,
	2 ft. 7 4/5 in.	2 1/8 in.	9 5/8 in.	8.47 lb	1,722 ft./sec.	4,920 ft.	salvo-launched
EMW "Taifun"	1,930 mm	100 mm	220 mm	29.5 kg	758 m/seg	15,800 m	Experimental, ground to air,
	6 ft. 4 in.	4 in.	8 5/8 in.	64.9 lb	2,486.2 ft./sec.	51,824 ft.	liquid propellant
Hs 217 "Föhn"	236 mm	73 mm	-	3 kg	437 m/seg	1,200 m	Operational, ground to air,
	9 3/8 in.	2 7/8 in.	-	6.6 lb	1,433.3 ft./sec.	3,936 ft.	salvo-launched.
							(35 units per launch)
"Reinbote"	11,400 mm	535 mm	1,490 mm	1,715 kg	1,889 m/seg	220,000 m	Operational,
	37 ft. 4 4/5 in.	1 ft. 9 in.	4 ft. 10 5/8 in.	3,773 lb	6,195.9 ft./sec.	721,600 ft.	ground to ground

TABLE 2

ROCKETS' MOTORS

Manufacturer	Propellant	Oxidizer	Pressurizer in kp.	Thrust	Stage	Propelled machine
BMW 109-511	M-Stoff	SV-Stoff	air	600	Flight Tests	IIs 298
BMW 109-548	R-Stoff	SV-Stoff	air	140	Flight Tests	"X-4"
BMW 109-558	R-Stoff	SV-Stoff	air	380	Flight Tests	Hs117 "Schmetterling'
EMW (A-3)	B-Stoff	A-Stoff	nitrogen	1500	Flight Tests	A-3
EMW (A-4)	B-Stoff	A-Stoff	T-Stoff/Z-Stoff	27500	Operational	A-4
EMW (A-5)	B-Stoff	A-Stoff	nytrogen	1500	Flight Tests	A-5
EMW (A-6)	Visol	SV-Stoff	T-Stoff/Z-Stoff	—	Flights Tests	A-6
EMW (A-8)	Diesel Oil	SV-Stoff	T-Stoff/Z-Stoff	—	Flights Tests	A-8
EMW (A-9)	Visol	SV-Stoff	T-Stoff/Z-Stoff	25000	Project	A-9
EMW (A-10/I)	B-Stoff	A-Stoff	T-Stoff/Z-Stoff	165000	Project	A-10/I
EMW(A-10/II)	Visol	SV-Stoff	T-Stoff/Z-Stoff	200000	Project	A-10/II
EMW(C-2)	Visol	SV-Stoff	nitrogen	8000	Flight Tests	"Wasserfall"
EMW (Taifun)	RV-Stoff	SV-Stoff	Cordite	1000	Flight Tests	"Taifun"
Konrad DVK	Visol	SV-Stoff	nytrogen	2000	Project	"Enzian IV"
Konrad —	Br-Stoff	SV-Stoff	nytrogen	2500	Project	"Enzian V"
Konrad —	Visol	SV-Stoff	nytrogen	2180	Flight Tests	"Rheintochter R3"
Rheinmetall Borsig 109-505	Solid	Solid	—	500	Flight Tests	"Feuerlilie F25"
Rheinmetall-Borsig 109-515	Solid	Solid	—	4000	Flight Tests	"Feuerlilie F55"
Rheinmetall-Borsig	Solid	Solid	—	7500	Flight Tests	"Rheintochter R1"
Rheinmetall-Borsig	Solid	Solid	—	16000	Flight Tests	"Rheintochter R3"
Rheinmetall-Borsig	Solid	Solid	—	14000	Flight Tests	"Rheintochter R3"
Schmidding 109-513	M-Stoff	A-Stoff	air	1000	Flight Tests	Hs 293H
Schmidding 109-543	Solid	Solid	—	150	Flight Tests	Hs298
Schmidding 109-553	Solid	Solid	—	1750	Flight Tests	"Schmetterling"
Walter 109-500	Z-Stoff	T-Stoff	air	500	Operational	take off trolley Rheinmetall-Borsig
Walter 109-502	Br-Stoff	SV-Stoff	T-Stoff/Z-Stoff	1500	Flight Tests	"Enzian I" y "Enzian III"
Walter 109-507	Z-Stoff	T-Stoff	air	590	Operational	Hs 293
Walter 109-729	B-Stoff	SV-Stoff	air	375	Flight Tests	Hs 117 "Schmetterling"
WASAG109-506	Solid	Solid	—	68	Flight Tests	"X-7"
WASAG 109-512	Solid	Solid	—	1200	Flght Tests	Hs 293

TABLE3
Propellants

A-Stoff	Liquid Oxygen (LOX) at -183º C, also called "Sauerstoff"
B-Stoff	Hydrazine hydrate, a catalyst for the T-Stoff and the M-Stoff
Br-Stoff	Non-refined petrol (benzine)
C-Stoff	Mixture of M-Stoff (57%), B-Stoff (30%), a watery solution (10 cc/lt) of potassium cuprocyanide (13%)
M-Stoff	Methanol (Methyl alcohol)
R-Stoff	(see "TONKA")
S-Stoff	Mixture of nitric acid (96%) and ferrous chloride (4%), also called "Salbei"
SV-Stoff	Mixture of nitric acid (94%) and nitrogen dioxide (6%), also called "Red fuming nitric acid"
T-Stoff	Hydrogen peroxide (Highly concentrated solution)
Z-Stoff	Watery solution of sodium or calcium as a catalist for the T-Stoff
Fantol	Phosphoriced alcohol used to ignite the mixture of SV-Stoff and Br-Stoff
Tonka	Generic name for a range of propellant mixtures based on vinyl ethers
Tonka 93	Mixture, by weight, of xylidine (20%), aniline (20%), ethylaniline (20%), isquexylamine (20%), sulphate benzine (10%) and a watery solution of benzol (10%)
Tonka 250	Mixture, by weight, of xylidine (50%) and triethylaminea (50%)
Tonka 500	Mixture, by weight, of xylidine (12%), aniline (15%), monomethylanilinea (22%), triethylamine (21%), sulfate benzine (16%) and a watery solution of benzol (14%)
Visol	Generic name for another range of propellants based on a mixture of vinyl ehters (isobutyl-vynil com-
pounds)	
Diglycol	Diglycol nitrate, a solid propellant mostly used for auxiliary rockets, formed by a mixture, by weight, of nitrocellulose (63%), di-ethylene glycol dinitrate (35%), carockets, formed by a mixture, by weight, of nitrocellu lose (63%), diethylene glycol dinitrate (35%), carbamite (0,5%), wax (0,2%) and graphite (1,3%)

TABLE 4
ABREVIATIONS

A	(Aggregate) Rocket produced by the HVP
AVA	(Aerodynamische Versuchs Anstalt) Aerodynamic research center in Götingen
BMW	(Bayerische Motoren Werke) Bavarian Engine Manufacturer
DFS	(Deutsche Forschungsanstalt für Segelflug) Center for Gliding Flight Research
DVL	(Deutsche Versuchsanstalt für Luftfahrt) Center for Experimental Flight Research in Seewald
DWM	(Deutsche Waffen und Fabriken) Government Institute Quality Control for Armament in Lübeck
EMW	(Elektro Mechanische Werke) Manufacturer of engines HVP in Karlshagen
FFA	(Flugfunk Forschungs Anstalt) Center for Research of Aircraft Radiotelephony in Munich
FKFS	(Institut für Kraftfahrzeuge und Flugmotoren) Research Institute for aviation engines of Stuttgart
Flak	(Flugzeug Abwehr Kanone) Anti-aircraft artillery
GL Flak	Project department of the LF
HAP	Launching battery for the HVProckets
HVP	(Heeres Versuchsanstalt Peenemünde) Research Institute of the Army in Peenemünde
HWA	(Heeres Waffen Amt) Army's armament Office in Berlin
HWK	(Hellmut Walter, Kommanditgesellschaft) For the Walter rockets made by Krupp in Kiel
LA	(Fliegende Verbände) Combat Air Force
LB	(Luftnachrichten Truppe) Signals Team of the RLM
LC	(Technisches Amt) Technical Office of the RLM
LF	(Flakartillerie) Anti-aircraft defense Group of the RLM
FLA	(Luftfahrt Forschungs Anstalt) Aeronautical Research Institute "Hermann Göring" in Braunschweig
LFM	(Luftfahrt Forschungs Anstalt-München) Research Institute of the Air Force in Munich
LGZ	(Luftfahrt Forschungs Anstalt-Graf Zeppelin) Aeronautical Research Institute Graf Zeppelin in Stuttgart
OKH	(Oberkommando des Heeres)High Command of the Army
OKL	(Oberkommando der Luftwaffe) High Command of the Air Force
OKM	(Oberkommando der Marine)High Command of the Navy
OKW	(Oberkommando des Wehrmachtsgeneralstabs) High Command of the Army Forces
RFR	(ReichsForschungs Rat) Government Group for Scientific Research
RLM	(Reichs Luftfahrt Ministerium) Ministry of Air
TAL	(Technische Akademie der Luftwaffe) Technical Academy of the Air Force in Berlin
V	(Versuchsmuster) Test vehicle, usually ended in a number
V-1	(Vergeltungswaffe-1) Vengeance weapon no. 1 (Fieseler Fi-103)
V-2	(Vergeltungswaffe-2) Vengeance weapon no. 2 (A-4)
Vfr	(Verein für Raumschiffahrt) Society for Spaceflight
WaF	(Waffen Forschung) Experimental division of the Wa Prüf.
Wa Prüf	(Waffen Prüffen) Armament Test Departament of the HWA
WASAG	(Westfälisch-Anhalltische Sprengstoff A-G) Explosive manufacturer of Westfalia
WVA	(Wasserbau Versuchs Anstalt-Kochelsee) Supersonic Tunnel of the HVP in Kochel
ZWB	(Zentralstelle für Wissenschaftliche Berichterstattung) Centralized Organisation fopr the broadcasting of Scientific Reports

REICHDREAMS SERIES

Arado Ar 234-V1
Arado Ar 234-V6
Arado Ar 234-V8
Arado Ar 234-B1
Arado Ar 234-B2
Arado Ar 234-B2 Nachtigall
Arado Ar 234-C1
Arado Ar 234-C2
Arado Ar 234-C3
Arado Ar 234-C3 N
Arado Ar 234-C4
* Arado Ar 234-C5 with Fritz X, Hs293 Series, Zitterrochen
* Arado Ar 234-C5 with Arado E 377
* Arado Ar 234-C5 with Lt 9.2 "Frosch", L10, GT1200, Bv 143, L11
Arado Ar 234-C6
Arado Ar 234-C7
Arado Ar 234-C8
Arado Ar 234-D1
Arado Ar 234-D2
Arado Ar 234-E
Arado Ar 234-Jäger (with X-4)
Arado Ar 234-Höhenjäger
Arado Ar 234-Heeresflugzeug
Arado Ar 234-B with Deichselschlep (long span)
Arado Ar 234-C with Deichselschlepp (short span)
* Arado Ar 234-B with SG-5041 V1
* Arado Ar 234-C/V1 (first Deichselschlepp)
* Arado Ar 234-C/V-1 (secon Deichselschlepp)
* Arado Ar 234-C/V-1 (Huckepack)
* Arado Ar 234-C/V1 (with Startwagen)
Arado Ar 234-R(a)
Arado Ar 234-R(b)
Arado Ar 234-P-1
Arado Ar 234-P-2
Arado Ar 234-P-3
Arado Ar 234-P-4
Arado Ar 234-P-5
Arado E-370 IVa
Arado E-370 TL
Arado E-381 (first version)
Arado E 381 (second version)
Arado E-381 (third version)
Arado E-555-2
Arado E-555-7
Arado E 555-11
Arado E-555-14
Arado E-560 with Hs 295
Arado E-580
Arado E-581-4, E 581-5
Arado TEW 16/42-43
Arado TEW 16/43-19 with Hs 294
Arado TEW 16/43-13 Raketenjäger
Arado Ar I-Bomber
Arado Ar I-Nachtjäger
Arado Ar II-Bomber
Arado Ar II-Nachtjäger (first version)
Arado Ar II-Nachtjäger (second version)
Bachem BP-20 M1
Bachem BP-20 M-3
Bachem BP-20 M-8
Bachem BP-20 V 15
Bachem BP-20 A
Bachem BP-20 B
* Blohm und Voss BV 40
Blohm und Voss P.163.01
Blohm und Voss P.163.02
Blohm und Voss P.170.01
Blohm und Voss P.177
Blohm und Voss P.178
Blohm und Voss P.179
Blohm und Voss P.188.01-01
Blohm und Voss P.188.04-01
Blohm und Voss P.192.01-01
Blohm und Voss P.193.01-01
Blohm und Voss P.194.00/01/02/03
Blohm und Voss P.196
Blohm und Voss P.197
Blohm und Voss P.198
Blohm und Voss P.202
* Blohm und Voss P.204
Blohm und Voss P.208.03
Blohm und Voss P.209-01
Blohm und Voss P.209-02
Blohm und Voss P.210-01
Blohm und Voss P.210-02
Blohm und Voss P.211
Blohm und Voss P.212-02
Blohm und Voss P.212-03
Blohm und Voss P.213

Blohm und Voss P.215 (with IIs 298)
Blohm und Voss P.237
Blohm und Voss Ae 607
* Blohm und Voss Manuell Gesteuertes Raketen Projektil
Von Braun Interceptors (first design)
Von Braun Interceptors (second design)
BMW Strahljäger - Projekt I
BMW Strahljäger - Projekt II
BMW Strahljäger - Projekt III
BMW Strahljäger - Projekt IV
BMW Strahljäger - Mit zwei Strahlturbinen -Entwürfe I
BMW Strahljäger - Mit zwei Strahlturbinen -Entwürfe II
BMW Strahljäger - Mit zwei Strahlturbinen -Entwürfe III
BMW Strahljäger - Mit zwei Strahlturbinen -Entwürfe IV
BMW Strahljäger - Mit zwei Strahlturbinen -Entwürfe V
BMW Strahljäger - Mit zwei Strahlturbinen -Entwürfe VI
BMW Schnellbomber I
BMW Schnellbomber II
BMW Strahlbomber I
BMW Strahlbomber II
Daimler Benz Projekt A
Daimler Benz Projekt B
Daimler Benz Projekt C
Daimler Benz Projekt D (B + C)
* Daimler Benz Projekt E
* Daimler Benz Projekt F
DFS-40
DFS-194
DFS-228
DFS-332
DFS-346
Dornier P.59
Dornier P.231/3
Dornier P.232/2
Dornier P.247/6
Dornier P.252/2-01
Dornier P.252/3-01
Dornier 232/3
Dornier 256/1
Dornier Do-345
Dornier Projekt Schnellbomber I
Dornier Projekt Schnellbomber II
* EMW A 4b (piloted)
* EMW A 9/A 10 (first version)
* EMW A 9/A 10 (second version)
* Fieseler Fi 103 A-1/Re 1
* Fieseler Fi 103 A-1/Re 2
Fieseler Fi 103 A-1/Re 3
Fieseler Fi 103 A-1/Re 4
Fieseler Fi 166 "Höhenjäger I"
Fieseler Fi 166 "Höhenjäger II"
Focke Achgelis Fa 269
Focke Wulf P.I
Focke Wulf P.II
Focke Wulf P.III
Focke Wulf P.IV
Focke Wulf P.V
Focke Wulf P.VI
Focke Wulf P.VII
Focke Wulf P.VIII
Focke Wulf Ta 183 Entwurf I
Focke Wulf Ta 183 Entwurf II
Focke Wulf Ta 183 Entwurf III
Focke Wulf "Super TL"
Focke Wulf Volksflugzeug
Focke Wulf 190 (Turbojet Variant)
Focke Wulf Triebflügel
Focke Wulf Ta 283
Focke Wulf "Super-Lorin"
Focke Wulf P.0310226-127
Focke Wulf P.0310025-1006
Focke Wulf P.0310251-13
Focke Wulf P.0310251-51
Focke Wulf J.P. 011-045
Focke Wulf J.P. 011-046
Focke Wulf J.P. 011-047
Focke Wulf J.P. 000-222-018
Focke Wulf Jäger Projekt mit BMW-803
Focke Wulf Volksjäger
Focke Wulf 1000 x 1000 x 1000 Projekt A
Focke Wulf 1000 x 1000 x 1000 Projekt B
Focke Wulf 1000 x 1000 x 1000 Projekt C
* "Gleiter Bombenflugzeug" 1945
Gotha Go 345 B
Gotha P.60A
Gotha P.60B
Gotha P.60C
Heinkel "T"
Heinkel P.1073-01-04
Heinkel P.1073-01-18
Heinkel P.1073-01-20

He 162 V 1
He 162 V 16
He 162 S
He 162 Trainer
He 162 A-2
He 162 A-6 ("V" tail)
He 162 B (1 Argus AS 044)
He 162 B (2 Argus AS 014)
He 162 (BMW 003 E + "V" tail)
He 162 D (swept back wing ant "V" tail)
He 162 C (swept forward wing and "V" tail)
He 162 HE (S011 A)
He 162 (BMW 003 R + Rocket)
* He 162 + Arado E-377 a
He 176 V-1
He 176 V-2
He 178 V-1
He 178 V-2
He 280 V-1 (glider)
He 280 V-1 (four As 14)
He 280 V-2 (two HeS 8a)
He 280 V-2 (two Jumo 004)
He 280 V-7 (glider)
He 280 V-8 (glider + "V" tail)
He 280 V-3
* He 343 A-1
He 343 A-2
He 343 A-3
He P.1065 IIc
He P.1065 IIIb
He 1068-01-80
He 1068-01-83
He 1068-01-84
He P.1073-01-04
Heinkel P.1077 Julia I
Heinkel P.1077 Julia II
Heinkel P.1077 Romeo
Heinkel P.1078 A
Heinkel P.1078 B
Heinkel P.1078 C
Heinkel P.1079 A
Heinkel P.1079 B (first version)
Heinkel P.1079 B (second version)
Heinkel P.1080
Heinkel "Wespe"
Heinkel "Lerche"
Henschel P.122
Henschel Hs-132
Henschel Hs-135
Horten I
Horten II/IID-10-125
Horten II M
Horten HV
Horten H II 1
Horten HVb
Horten HVc
Horten parabel
Horten III b
Horten III d
Horten III e
Horten III f
Horten H IV
Horten II VII
Horten H VIII
Horten H IX V1
Horten H IX V2
Horten H IX V6
Horten H XIIIa
Horten II XIIIb
Horten H XVIIIa
Horten H XVIIIb
Horten H X (research)
Horten H X (fighter)
Junkers EF 008
Junkers EF 009
Junkers EF 010
Junkers EF 011
Junkers EF 015
Junkers EF 017
Junkers EF 018
Junkers EF 019
Junkers EF 112
Junkers EF 116
Junkers EF 122
Junkers EF 125
Junkers EF 126
Junkers EF 127
Junkers EF 128
Junkers EF 128 (Night Fighter)
Junkers EF 130
Junkers Ju 287 V1
Junkers Ju 287 V3
Junkers Ju 287 V5
Lippisch DM-1
Lippisch P.11 fighter
Lippisch P.11 bomber
Lippisch P.12

Lippisch P.13
Lippisch P.15
Lippisch P.20
Lippisch Supersonic Flying Wing
Lippisch P.01-111
Lippisch P.01-113
Lippisch P.01-114
Lippisch P.01-115
Lippisch P.01-116/I
Lippisch P.01-116/II
Lippisch P.01-117
Lippisch P.01-118
Lippisch P.01-119
Lippisch Li 163 S
Messerschmitt 109 T1
Messerschmitt Me 163 A
Messerschmitt Me 163 B
Messerschmitt Me 163 C
Messerschmitt Me 163 DV-1
Messerschmitt Me 263 V 1
Messerschmitt P 65
Messerschmitt P 1065
Me 262 V1 (Jumo 210)
Me 262 V1 (Jumo 210 + 2 BMW-P.3302)
Me 262 V2
Me 262 V5
Me 262 V6
Me 262 V9
Me 262 V10 + 1000 kg rigid tow pole
Me 262 A-1a/U1
* Me 262 A-2a
Me 262 Schnellbomber Ia
Me 262 Schnellbomber II
Me 262 A-2a/U2
* Me 262 A-1a
Me 262 B-1a
Me 262 Aufklärer II
Me 262 A-5a
Me 262 A-1a/U3
Me 262 A-1b
Me 262 A-1a/U4
Me 262 HG I
Me 262 HG-II
* Me 262 HG-III
Me 262 Mistel
Me 262 C-1a
Me 262 C-2b
Me 262 Interzeptor III
Me 262 C-3
Me 262 lorin (2 Jumo 004B + 2 Lorin)
Me 262 B-2 (Jumo 004B, or HeS 011A, or DB-021)
Me 262 three-seat Night Fighter
Me 262 B-1a/U1
* Mistel 4 (Me 262 A-1a/Ju 287 B)
* Me 328 A-1
* Me 328 A-2
* Me 328 A-3
* Me 328 B-1
* Me 328 B-2
* Me 328 B-3
* Me 328 V1 + Do 217 E
* Me 328 C
Me P1099 B
Me P.1.100 Schnellbomber (Jumo 004 C)
Me P.1100 (HeS 011-A)
Me P.1101-V1
Me P.1102
Me P.1103/1104 Bordjäger
Me P.1106
Me P.1107/I
Me P.1107/II
Me P.1108
Me P.1110/I
Me P.1110/II
Me P.1111
Me P.1112
Me P.1116
Sänger-Bredt (one engine)
Sänger Bredt (two engines)
Miethe Flying Disc
Schriever Flying Disc
Schriever/Habermol Flying Disc
Skoda Kaube P.14
* Sombold So.344
Zeppelin Fliegende Panzerfaust
* Zeppelin Rammer

Original developments from invaded countries

De Schelde S.21 (FW-198) (Holland)
Payen P.A.112 C1 (P.A.22) (France)
Caproni Reggiane 2007 (Italy)

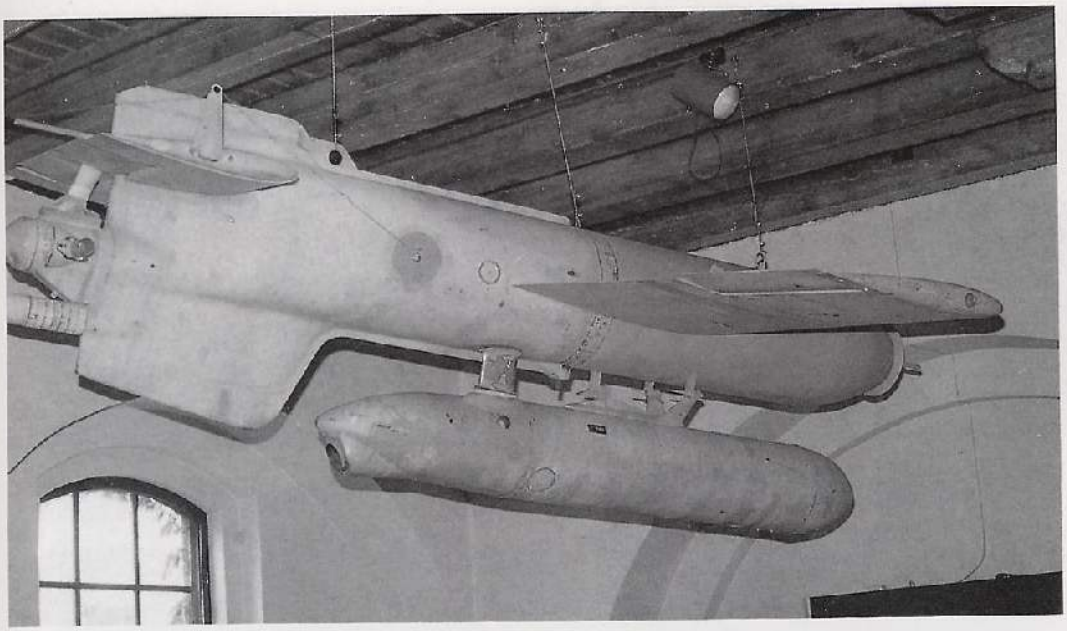
Missiles

* Arado E-377 A
* Blohm und Voss BV-143

* Blohm und Voss BV 246 "Hagelkorn"
* Blohm und Voss L-10
* Blohm und Voss L-11
* BMW X-4
* BMW X 7 "Rotkäppchen"
* EMW A3/A5
* EMW A-4 (V-2)
* EMW A6/A8
* EMW A7
* EMW C2 "Wasserfall"
EMW "Taifun"
* Fieseler 103 (V-1)
* Henschel GT.1200
* Henschel 117 Schmetterling
* Henschel 293
* Henschel 294
* Henschel 298 V1 and V2
* Henschel "Zitterrochen"
* Messerschmitt "Enzian"
* Rheinmetall-Borsig "Hecht" 2700
* Rheinmetall-Borsig F25 and F55
"Feuerlilie"
Rheinmetall-Borsig "Rheinbote"
* Rheinmetall-Borsig "Rheintochter" I and III
* Ruhrstahl/Kramer X-1 "Fritz X"

* (In this volume)

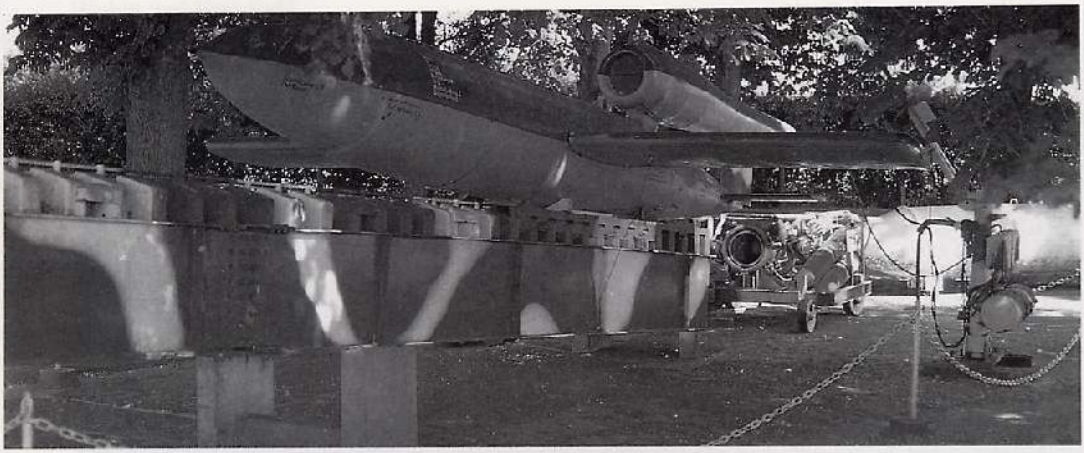
HS 293

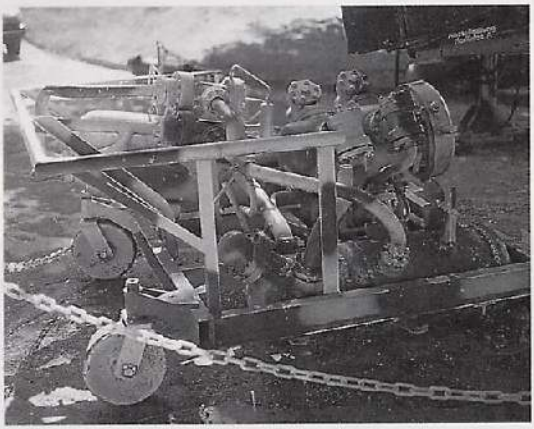


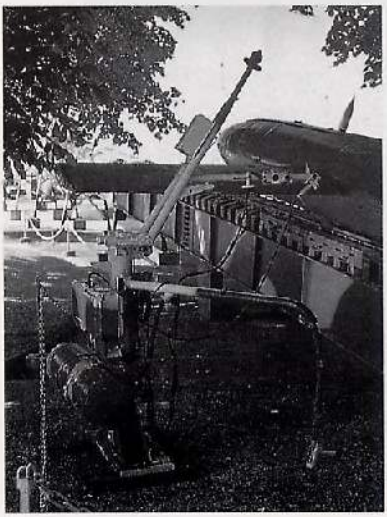
One of the rare Henschel Hs 293 at the Oslo Defense Museum.

Ruhrstahl Kramer "Fritz X" and Hs 293 at Prag/Kbely.

Fiesler Fi103/V-1

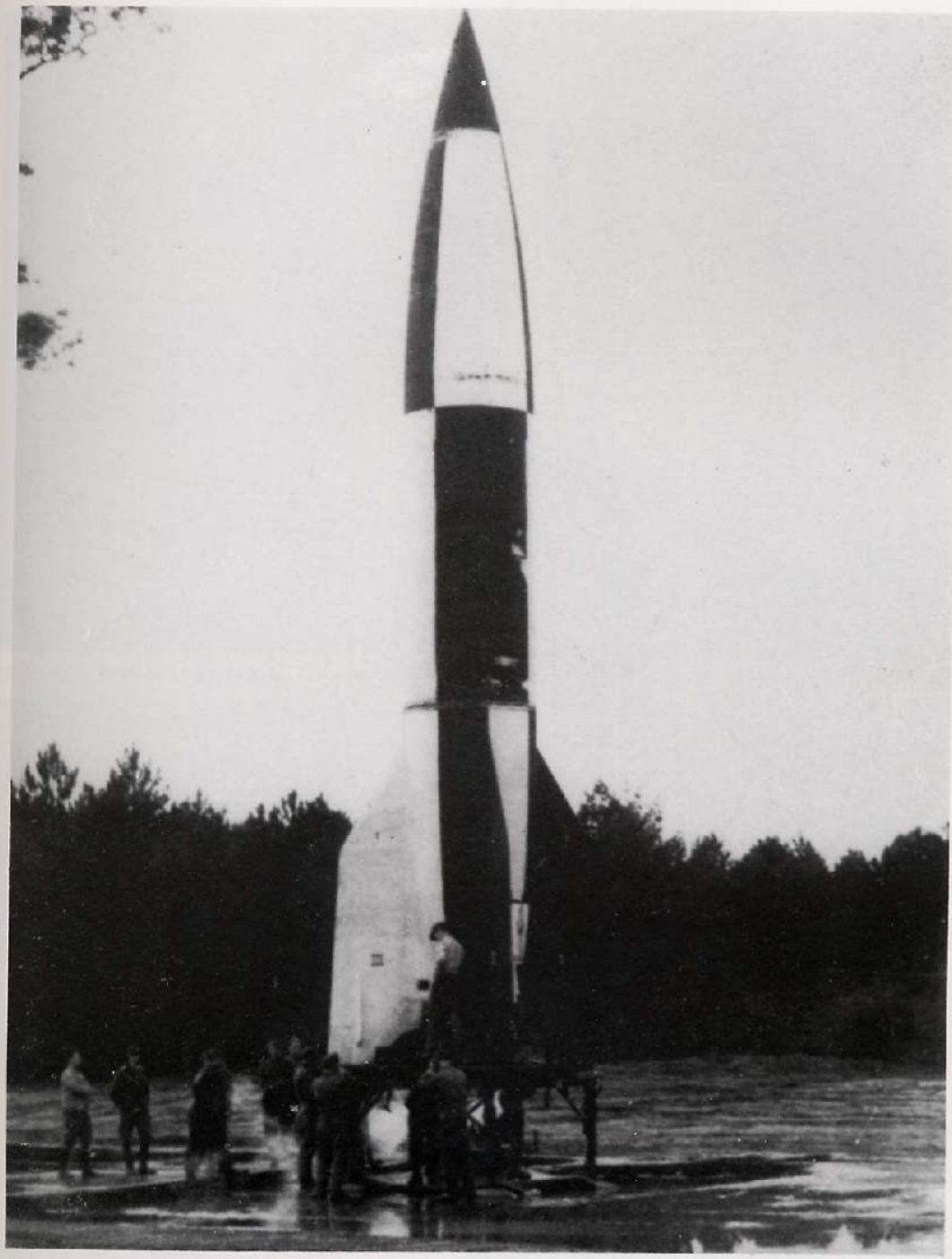






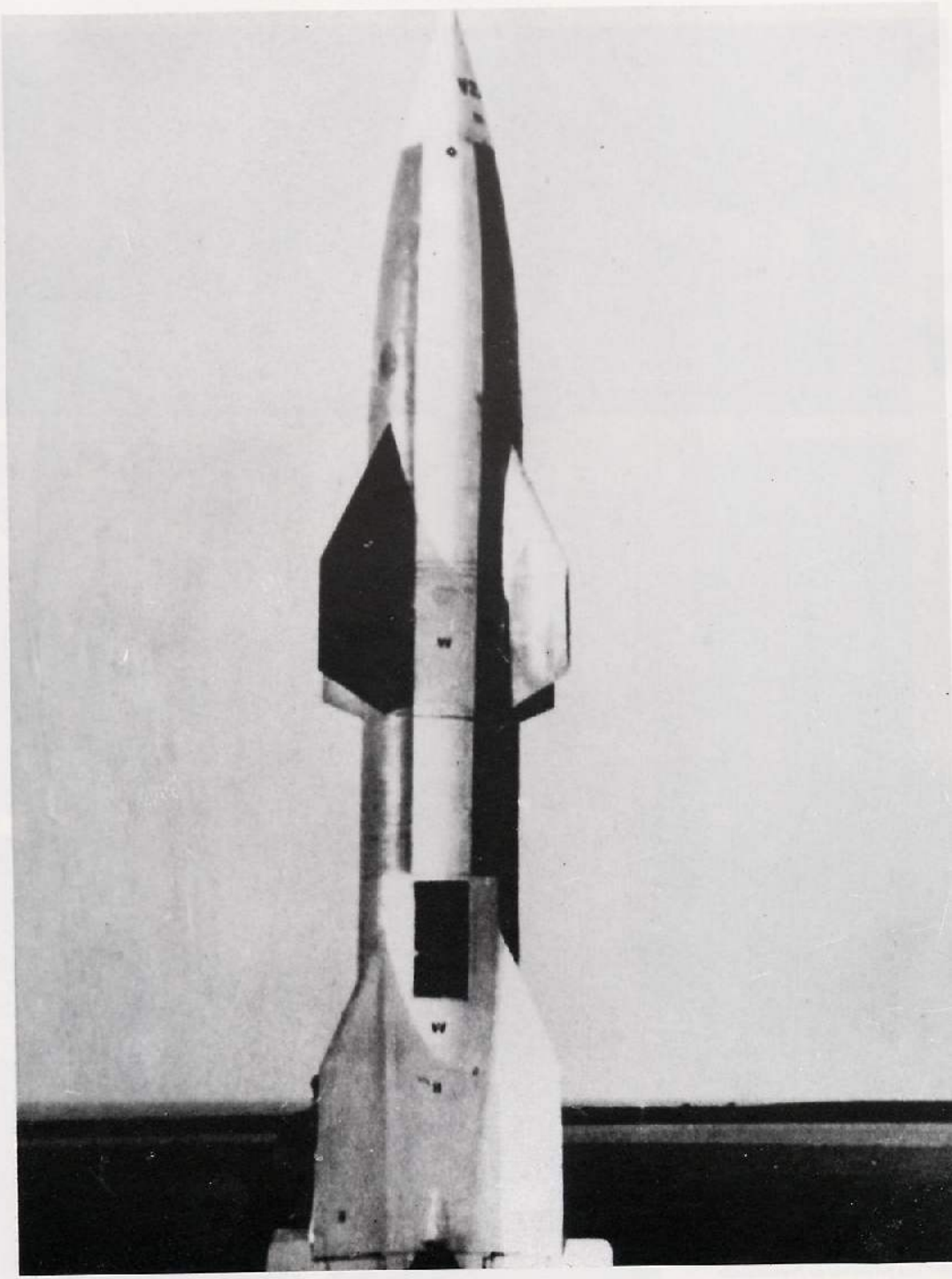
The pictures on this page show a complete V-1 (no ball) ramp with its respective ground equipment, restored at Duxford, England.

A4/V2



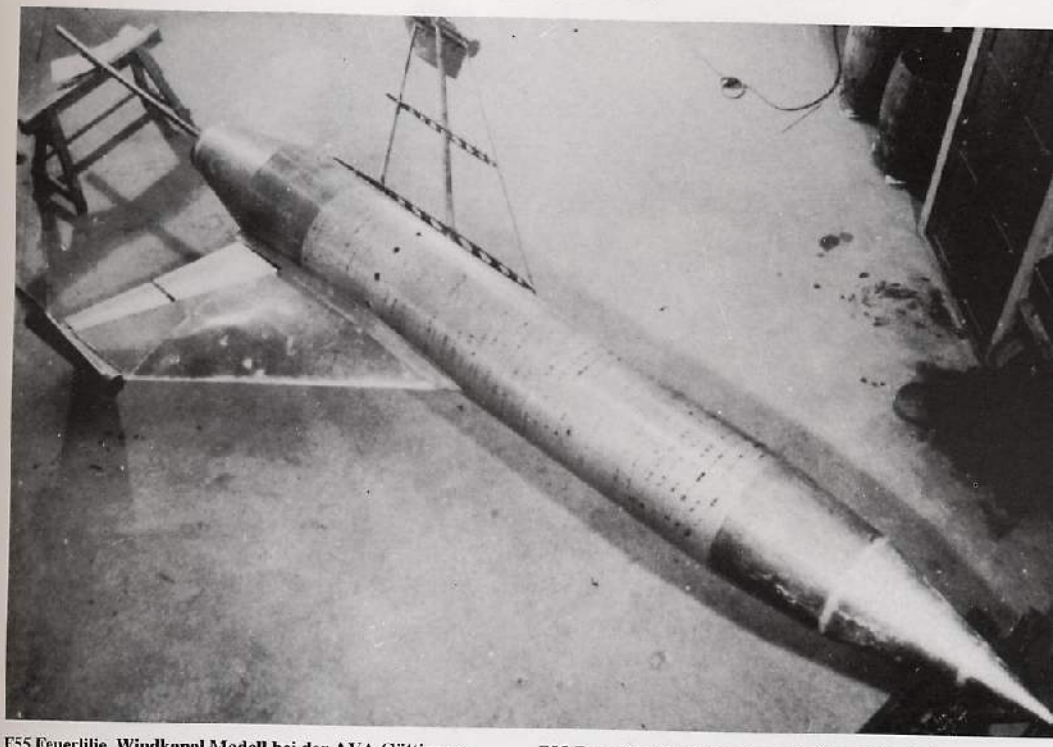
A4/V2 test projectile at Peenemünde.

Wasserfall



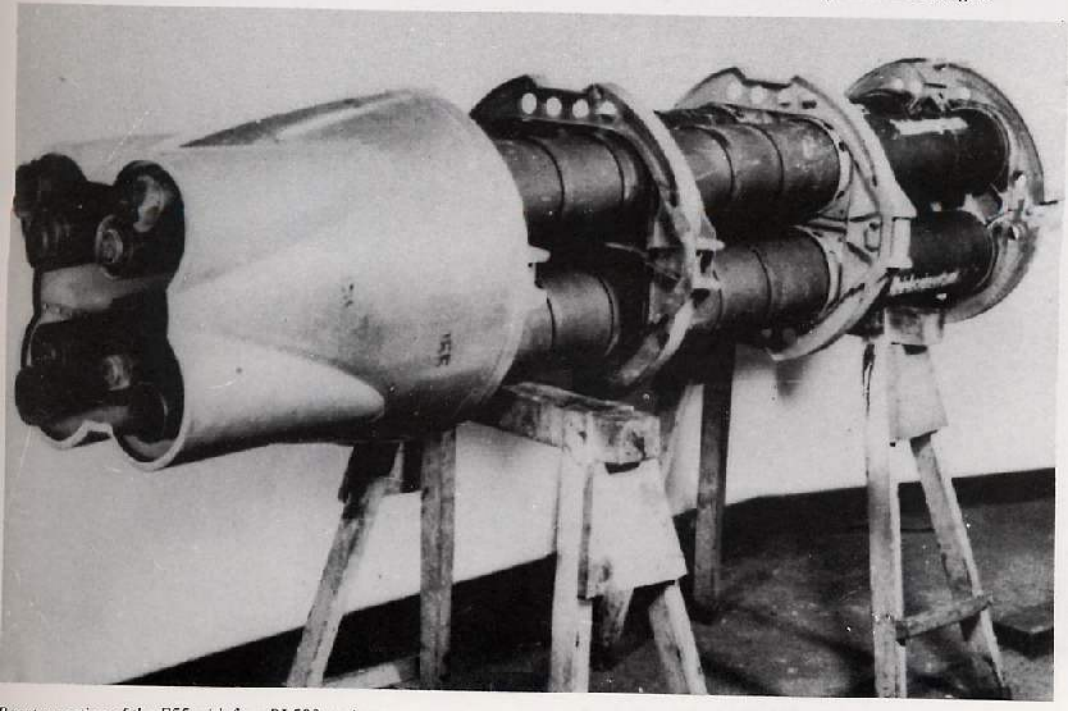
Test projectile of a Wasserfall ready for launch at Peenemünde.

Feuerlilie

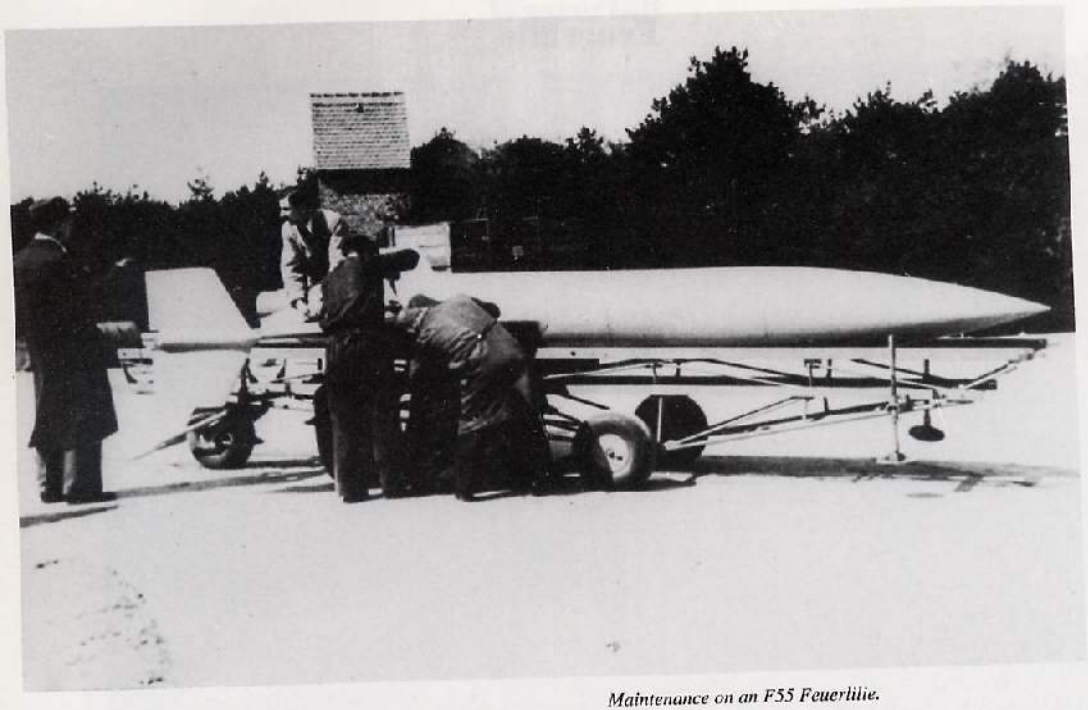


F55 Feuerlilie. Windkanal Modell bei der AVA Göttingen.

F55 Feuerlilie. Windtunnel model of the AVA Göttingen.



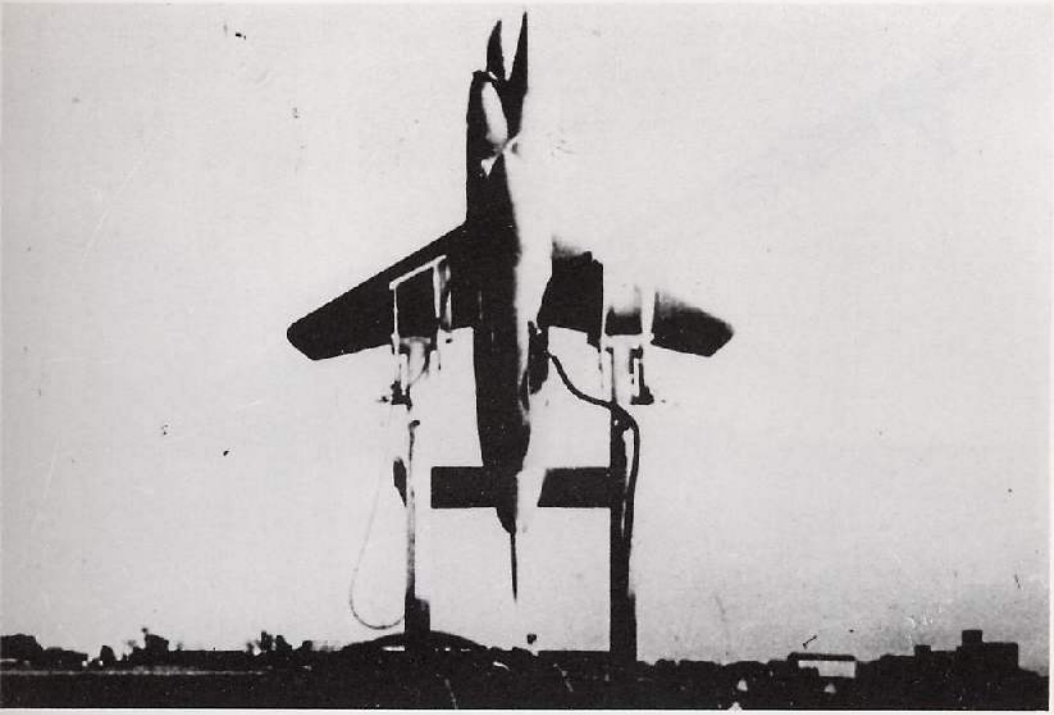
Booster section of the F55 with four RI 503 rockets.



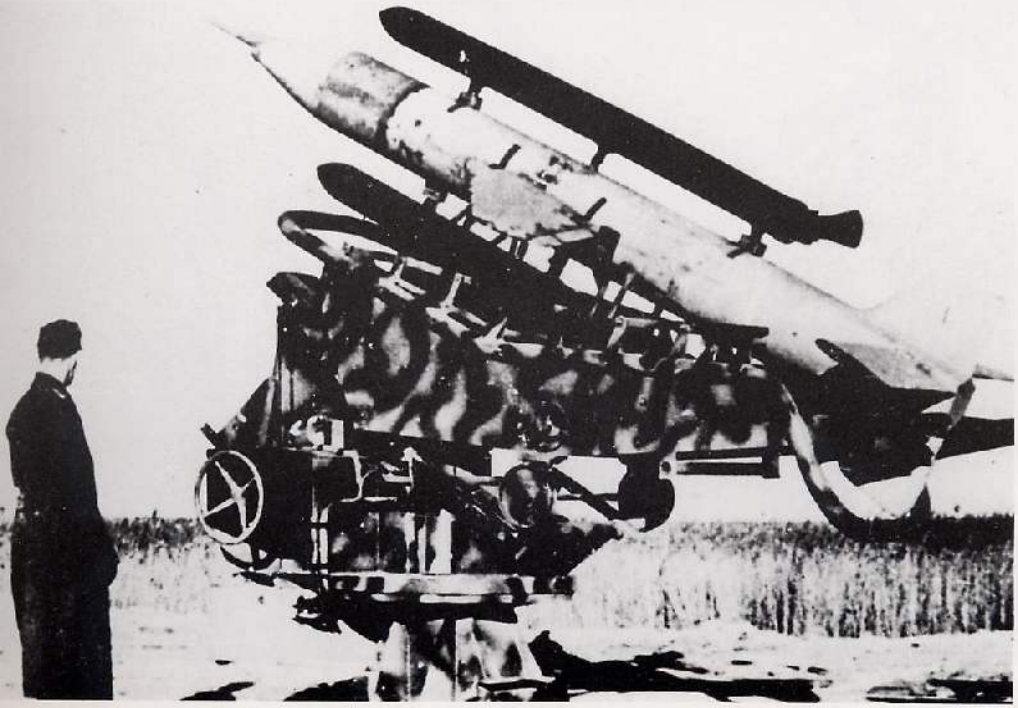
Maintenance on an F55 Feuerlilie.

Transport of an F55 Feuerlilie to its launcher.

Flakrakete Hs 117



Hs 117 Flakrakete auf einem provisorischen Abschußgestell. *Hs 117 Flak-missile on a provisional launcher.*



Production unit of a Hs 117 battery.

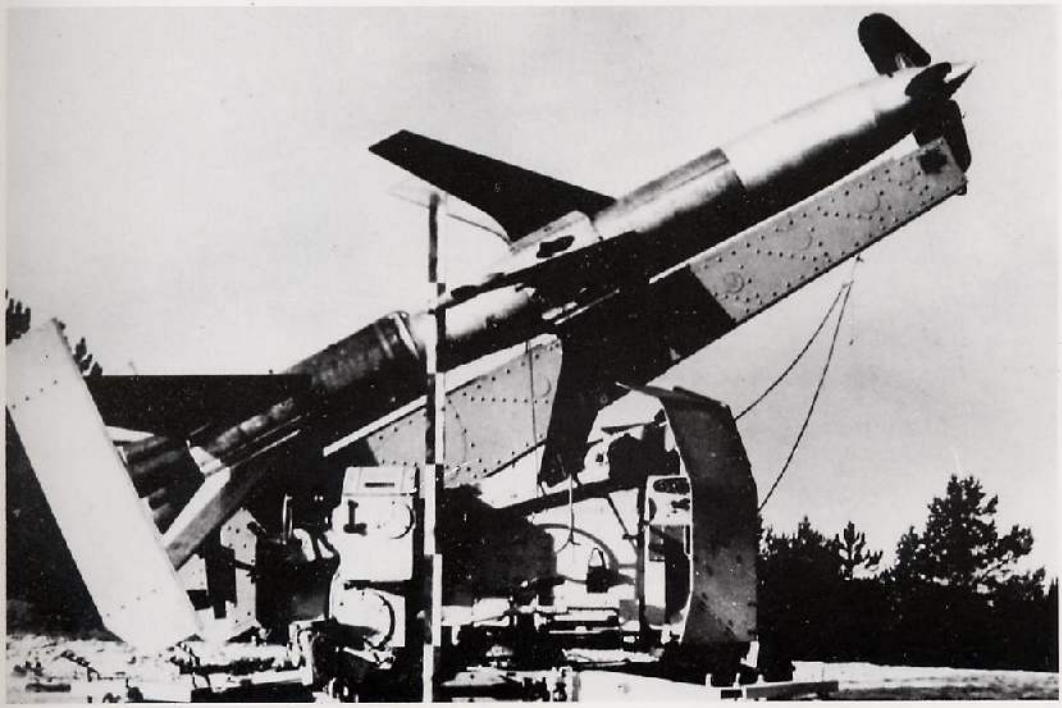
Enzian

Enzian on an modified launcher, based on the 8,8 cm Flak ready for series production.

Preparation of an Enzian launcher for a test shot.

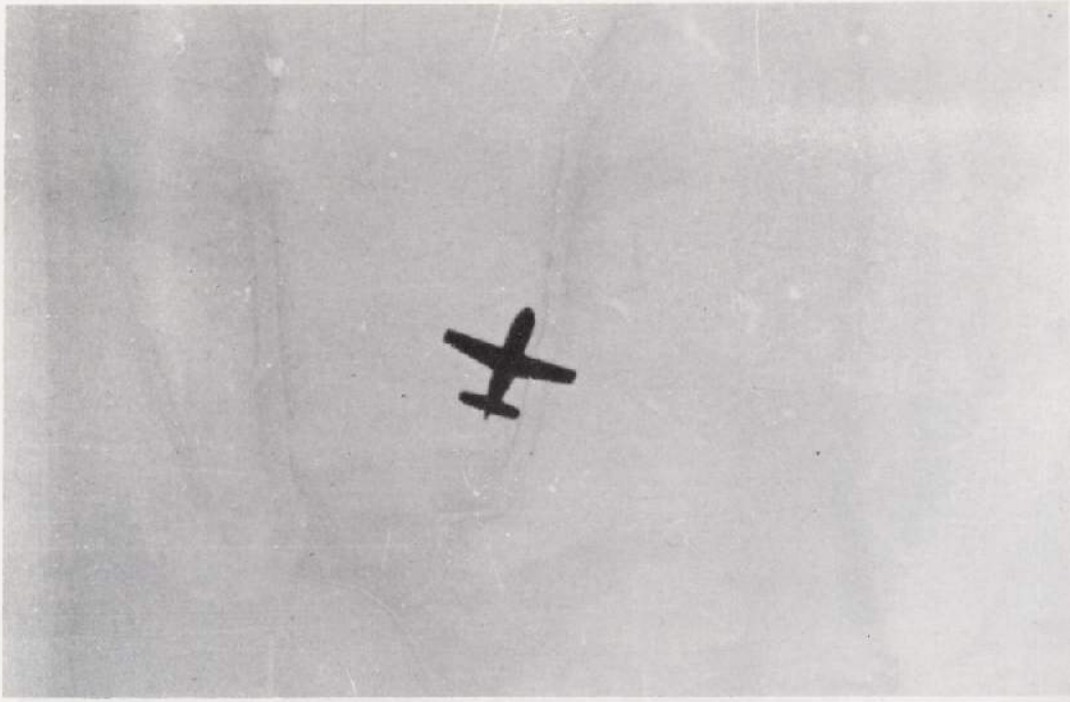
Rheintochter

Launch of an Enzian at Karlshagen.



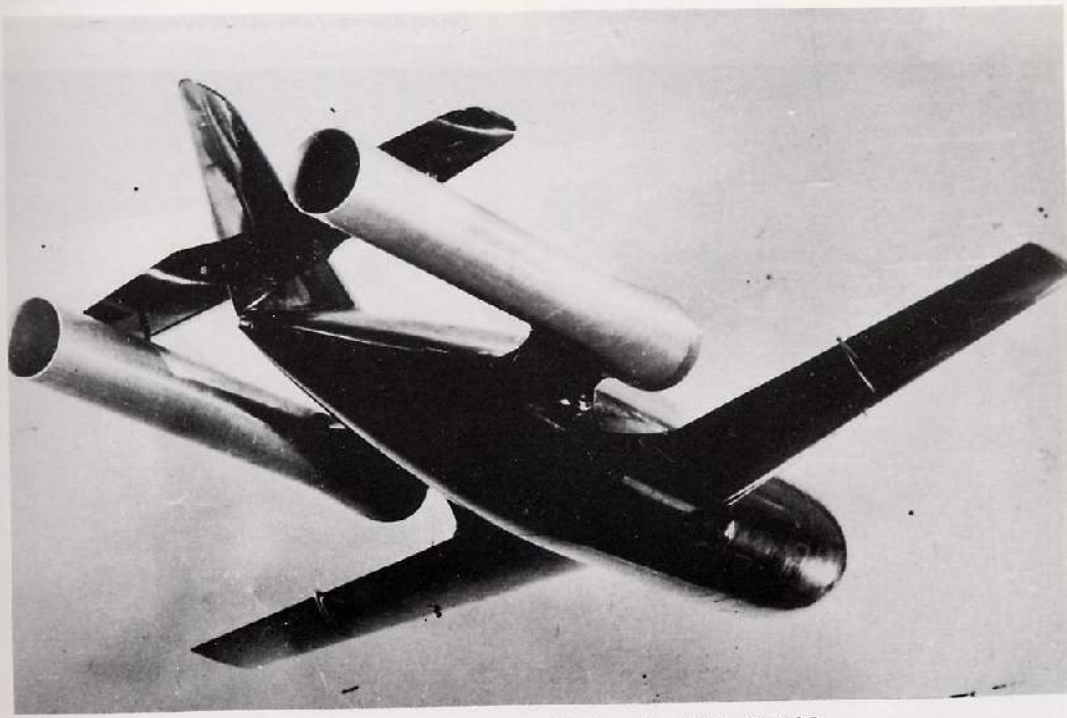
The mighty Flak missile Rheintochter on its launcher.

Me 328 B0/B1 on top of a Dornier Do 217 E (JT+FL) during initial flight tests.



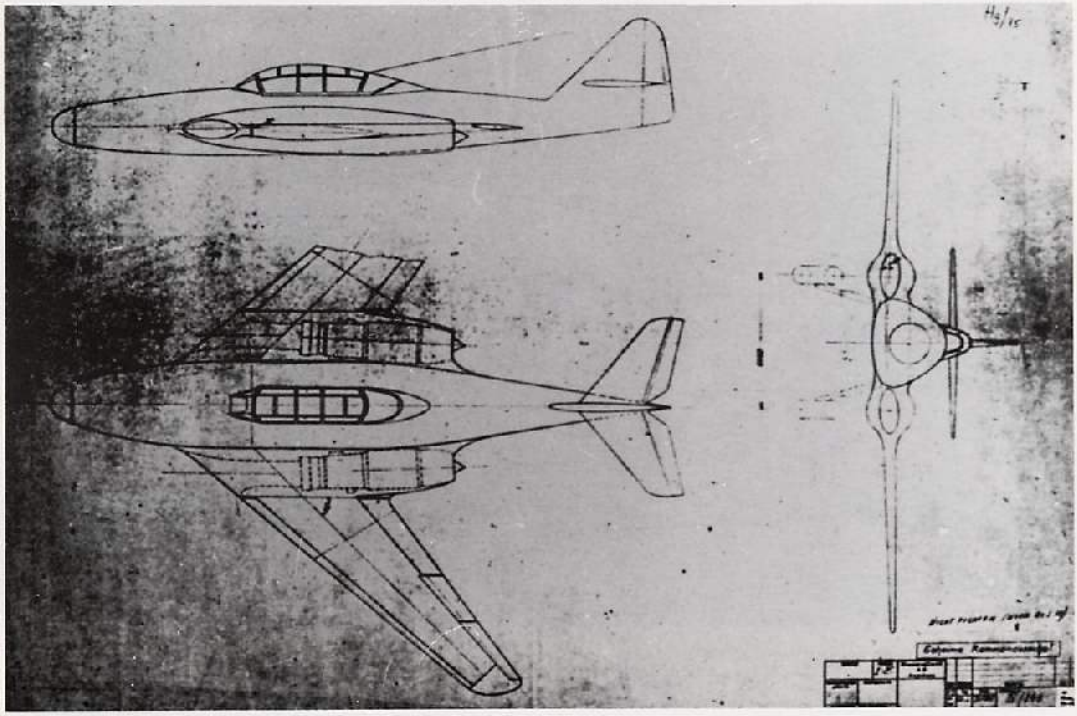
Me 328 V1 during initial free flight gliding tests.

Me 328 V1 on final.

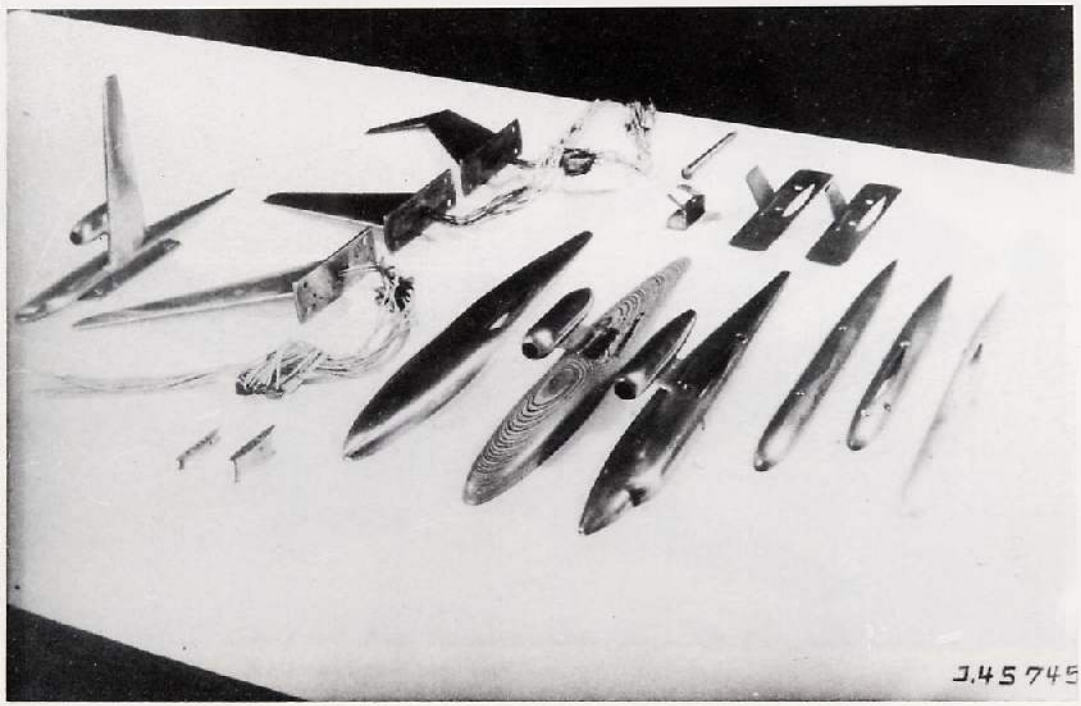


Wind tunnel model of a Me 328 B.

Me 262 HGIII

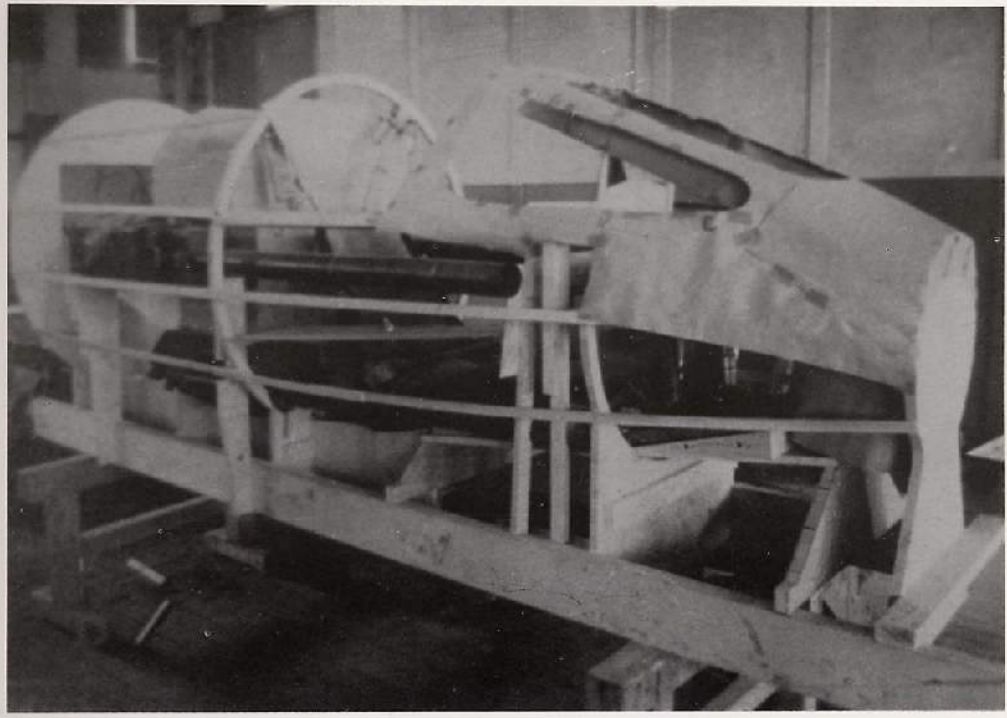


Factory drawing of a Me 262 HG III two seat version.



Windtunnel models for different high speed projects.

Me P 1112



Cockpit mock up of the Me 1112 project.

Initial flight tests with a Me 1112 scale model.