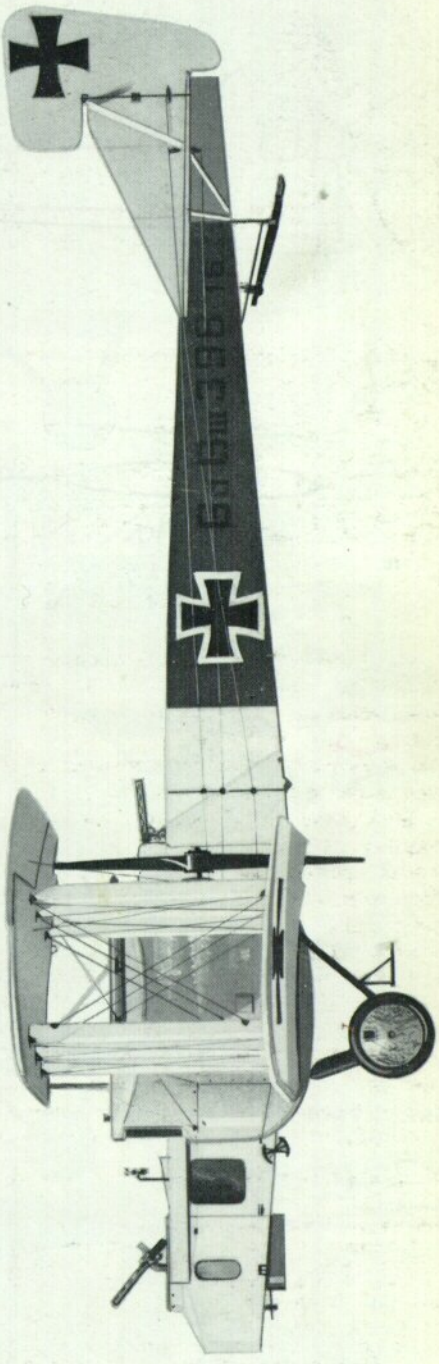
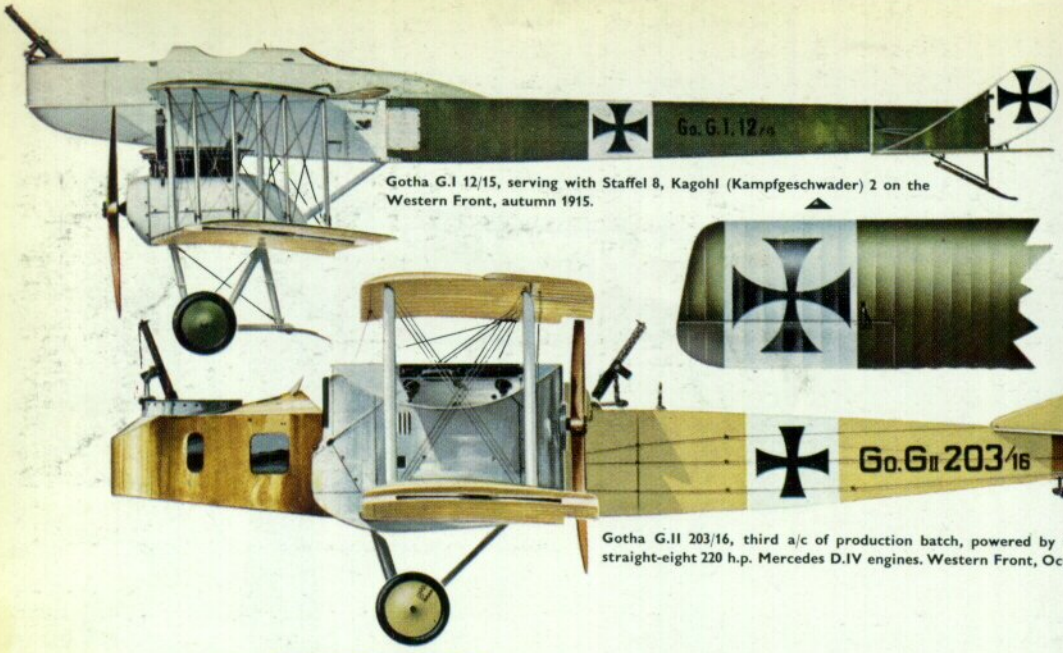
PROFILE
PUBLICATIONS

The Gotha GI-GV



NUMBER 115
TWO SHILLINGS



Gotha G.I 12/15, serving with Staffel 8, Kagohl (Kampfgeschwader) 2 on the Western Front, autumn 1915.

Gotha G.II 203/16, third a/c of production batch, powered by two geared straight-eight 220 h.p. Mercedes D.IV engines. Western Front, Oct.-Dec. 1916.

Gotha G.IV 604/16, serving with Kagohl (later Bombengeschwader) 3 on Ghent airfield complex, Belgium, June 1917. Daylight attacks over Britain.

Gotha G.IV (L.V.G.) powered by two 230 h.p. Hiero engines, delivered to Austrian air service at Aviano airfield in the spring of 1918.

Go. G. IV (L.V.G.) H. 230
0811

Leergewicht		2541 Kg
Betriebsmittel.	Benzin	659 Kg
" " "	Oel	25 Kg
" " "	Wasser	65 Kg
Nutzlast		734 Kg
Kriegsmassiges Gewicht		3934 Kg

Gotha G.Vb 935/18, delivered to the Front in August 1918.

The Gotha GI-GV

by Peter M. Grosz

The Friedel-Ursinus B.1092/14 being inspected by interested officers at FEA 3 at Darmstadt. Oskar "Papa" Ursinus is seen here in the front gunner's position of his design, the forerunner of the Gotha bomber series which brought the British civilian population under direct attack for the first time in 150 years. (Unless otherwise indicated, all photographs are from the author's collection).

On 26th October 1914 a tiny Gotha *Taube* broke the silence of peace over Dover and dropped the first bombs on British soil. Harmless as it then seemed, this daring exploit presaged the future. In two World Wars, the aeroplane was to be the instrument by which total war, or to put it in refined terms, strategic warfare, would come to civilians living in cities far behind the lines of battle. In past wars, the Spanish and French had failed to harm the Island Kingdom from the sea, but the Germans would strike from the sky. Where the Zeppelin, that white elephant in the Germany armoury, failed, the winged bomber was to finally succeed. This bomber was known as the Gotha.

To the British public, too obsessed with their wartime plight to remember that both sides had already bombed defenceless cities, the word Gotha became, with the U-Boat, a synonym for Teutonic terror.

The Gothas droning across English skies were regarded with a mixture of fear and resoluteness by a people tired of war, sick of killing and living a drab existence on short rations. Although the material damage was small compared to the incredible devastation of cities in the Second World War, the British government for once reacted with uncommon speed to combat what may have been the final break in already dangerously stretched British morale. How close the Gothas came we can only guess. The bomber's impact on future military thinking was considerable. For this, the Gotha belongs to the ranks of famous war weapons.

The origin of the Gotha can be traced back to the summer of 1914 when Oskar Ursinus laid out a design for a novel twin-engined seaplane. It was characterized by a short-nosed fuselage suspended from the upper wing and by engines placed so close together on the lower wing that the propeller tips almost touched. The purpose of this awkward configuration was to balance the projecting floats and reduce the asymmetric moment with one engine out. The outbreak of war interrupted all peacetime aspirations. Almost immediately the demand for front-line aircraft became insatiable. As attested by the variety of aircraft proposed and built in 1915, the German military machine seemed willing to support almost any venture.

Oskar Ursinus was no newcomer to German aviation. He was already well-known as the editor of the popular aviation journal "*Flugsport*" which he founded in 1908 and continued to edit until 1945. "Papa" Ursinus was to become even more famous as the beloved *Rhönvater*, the guiding spirit and ardent supporter of early German gliding activities on the *Wasserkuppe* and elsewhere. Ursinus, who had joined the Army, now submitted to the military authorities his twin-engined design as an armed and armoured *Kampfflugzeug* (battleplane). This configuration met the requirements of the Type III category of military aircraft proposed in March 1914 for development in 1915-1916. The proposal called for an armed, three-man, 200 horsepower (i.e.: twin-engined) biplane with six-hour flight duration and equipped to attack ground targets with machine guns.

Ursinus developed the aeroplane with Major Friedel, the commander of *Flieger Ersatz Abteilung 3* (*FEA*—Aviator Replacement Unit) in Darmstadt. Although it is referred to as the Friedel-Ursinus aircraft in German literature, Ursinus received sole credit for the design under Patent 307,382, filed in 1914, because officers were not allowed to patent inventions.

Designated B.1092/14 (the "G" classification was not yet in use), the Friedel-Ursinus biplane was constructed in the *FEA 3* workshops by military personnel. All excess airframe capacity was already wholly committed to supplying urgently needed replacements for the Front. The machine first flew in January 1915. The high fuselage with its unencumbered view gave the forward gunner a magnificent field of fire. Chrome-nickel armour, weighing 200 kg. (440 lbs.), protected the crew and engines from ground fire.

Dr. Ing. Heller of the Central Acceptance Commission, who evaluated the B.1092/14 before it was shipped to the Front, recommended the further development of the type despite its many shortcomings. His report, dated 20th February 1915, began by noting these advantages: good visibility and field of fire in all directions; closely mounted engines that made it easier to maintain flight on one engine and the general design was recommended for development as a battleplane. The disadvantages listed were: the high fuselage was dangerous to the

The Gotha G.I prototype, note that the outer diagonal strut has been eliminated. Ursinus is in the centre cockpit, and the pilot in the rear position holds a "lucky" pig

observer in case of a nose-over; the fuselage was weak and subject to torsional deformation; the ailerons were too small and did not have sufficient movement; stick control was unsuited for large aircraft; the two right-hand engines should be replaced by left and right-hand engines; 150 h.p. engines should be fitted (instead of 100 h.p. engines) for better speed and climb, and the armour should be discarded due to changed operational requirements.

The last comment referred to the fact that the "war of movement" had crystallized into trench warfare and the low-flying "cavalry" attack and reconnaissance missions were no longer required.

In the early months of 1915, the B.1092/14 was sent to *Feld Flieger Abteilung 28* (Field Reconnaissance Flight) on the Eastern Front. This flight was attached to the Ninth *Armee* of which Major Friedel was now aviation staff officer. There the B.1092/14 performed all kinds of duties and at one time was crudely fitted out as a bomber. Although not originally intended as such, the B.1092/14 was the first *twin*-engined German bomber at the Front. No bomb-sight was carried and the bombs were dropped by hand. The observer in the middle cockpit, having

The B.1092/14 at Feld Flieger Abteilung 28; *the cowlings have been removed for better cooling and new radiators installed. Note the "FU" monogram on the nose. This was the first German twin-engined bomber of the war.* (Photo: Egon Krüger)

The B.1092/14 on January 27th 1915, probably preparing for the first flight.

no moving troops to spot, was excess baggage. In later versions he was either given a machine gun or the position was eliminated altogether. The nose cockpit was of generous dimensions with enough room to mount a 2 cm. cannon for demonstration purposes. Actually the 2 cm. Becker cannon was not ready for aircraft use until late 1917.

The B.1092/14 had proved a useful type and the *Inspektion der Fliegertruppen* (*Idflieg*—Inspecorate of Aviation Troops) urged Dir. Kandt of the Gothaer Waggonfabrik to produce the aircraft in series. The chief engineer, Hans Burkhard, voiced strong opposition, but management prevailed. So the Gotha works, which had begun to build aircraft in 1912, acquired a license from Ursinus in March 1915 to construct his patented design. This action also coincided with Gotha management's decision to concentrate on multi-engined landplane production for the remainder of the war. The Friedel-Ursinus project was assigned to Ing. Burkhard, a Swiss citizen who had joined Gotha on 1st October 1914 as chief engineer of the landplane construction department. He now lives in retirement after an active post-war career in Swiss aviation.

Burkhard appreciably simplified and improved the design. The armour became part of the load-bearing structure (it was omitted on later models), but otherwise, the Gotha G.1 as it was now called (*Grossflugzeug* or large aircraft) was of conventional wood, wire and fabric construction. The first G.1 rolled from the factory on 27th July 1915. Gotha built between twelve and twenty G.1 battleplanes (serial numbers G.9/15 to 14/15 and G.40/15 to 43/15 have been identified). The G.9/15 and 10/15 were sent to *Sonderstaffel S.1* (Special squadron) in Darmstadt; the G.12/15 to *Kampfgeschwader 2, Staffel 8* (*Kagohl*-Battle Wing); the G.13/15 to *Feld Fl. Abt. 37;* the G.40/15 to *Feld Fl. Abt. 5* and G.41/15 to *Kagohl 1.* A Gotha G.1 also flew in *Feld Fl. Abt. 46.* In October and December 1915, five and six machines respectively were at the Front, and from

B.1092/14 in flight at FEA 3.

then on one G.1 remained at the Front until October 1916. (See chart No. 1).

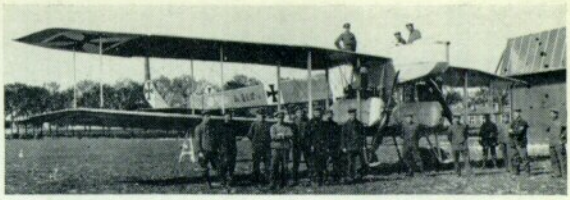
The basic shortcoming of the top-heavy design was illustrated by the fate of the G.9/15. It nosed over on landing and was badly damaged. Burkhard rebuilt it with the fuselage on the lower wing, thereby setting the stage for the later Gotha bombers. Similarly, the G.14/15 crashed at *Armee Flugpark Falkenhausen* on 3rd October 1915 killing the pilot and the observer. Besides the proneness to nose-over, the crash analysis pointed out another fault: the basic structure was not robust enough and collapsed too readily.

It is interesting to note that Ursinus' original seaplane project was realized in the Gotha UWD floatplane (Navy number 120) which was ordered by the Navy in April 1915, delivered in January 1916 and accepted in February by the German Navy. On one of its acceptance flights at Warnemünde, it lifted six men into the air, virtually the limit of its useful load. When they all climbed out, one by one, a surprised and astounded member of the acceptance commission nicknamed the UWD the "Trojan Horse". According to one report, the UWD flew in several combat missions, once even bombing Dover from 2,700 metres (8,900 feet). The UWD was written off when it collapsed on a hard touch down at Zeebrügge, again a victim of weak structure.

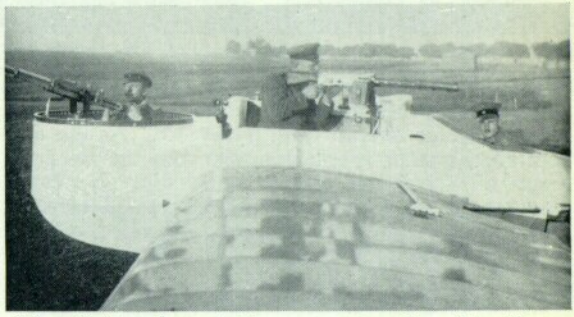
In retrospect one can see that the high-fuselage biplane configuration was never very popular with aircraft designers. It was used on the Dornier Rs.III and Rs.IV flying boats during the war and between the wars on the Latecoere 6, the Hanriot HD 24 and the Handley Page H.P. 50 "Heyford". Initially the reason for the high fuselage was to place the engines close together to avoid asymmetric flight conditions should an engine fail. These fears were groundless for subsequent flight experience proved that engine-out flight was possible with conventional multi-engined types. Ursinus designed one more unusual aircraft during the war, a remarkably modern seaplane fighter with retractable floats. It was too far ahead of its time and not developed further.

The war was two months old when Major Siegert of the German air staff proposed the creation of a bombing force to attack England. Indeed, a wing of six squadrons code named *Brieftauben Abteilung Ostende* (*BAO*—Carrier Pigeon Section) was activated in November 1914 and preparations to bomb England were begun. It was planned to launch attacks from Calais; to England's good fortune this port remained in Allied hands. The range and performance of the early German biplanes were inadequate to reach England from the Belgian coast in all but ideal flying conditions. The *BAO* was transferred to another sector. But the seed had been sown and the German air staff continued to cast an agressive eye across the Channel. It would be another two years before England would feel the first blows of mass bombing by aeroplanes.

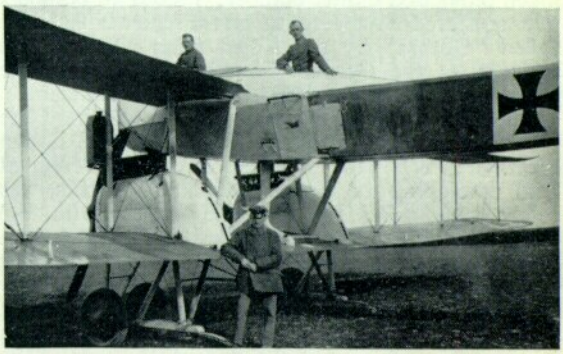
In 1915-1916 the German aircraft industry had brought out a variety of experimental twin-engined aircraft designed as battleplanes. Initially known as Type III, then as Type "K" (for *Kampfflugzeug*—battleplane) and in 1915 as Type "G" (for *Grossflugzeug*) these machines were maids of all work. Armed with one or two machine guns and manned by a crew of three, the battleplane roamed the skies performing a variety of tactical assignments. They protected friendly observation machines and attacked those of the enemy. They flew defensive zone patrols,



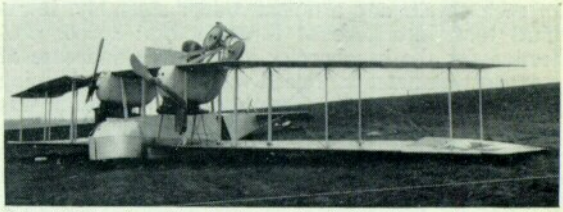
G.I 12/15 in service with Kagohl 2, Staffel 8.
(Photo: E. Krüger)



Oskar Ursinus demonstrating an early version of the 20 mm. Becker cannon in the forward position of a G I.
(Photo: W. Puglisi)



Gotha G.I, showing springs on undercarriage to ease landing shock when tail touched down. Ursinus trademark just visible on panel below cockpit. (Photo: E. Krüger)



G.I, 14/15 after the fatal crash of Lt. Franz Rosenfeld in October 1915, demonstrating the danger of a high-fuselage nose-over. The accident occurred at Armee Flugpark Falkenhausen *on the Western Front.* (Photo: W. Puglisi)

carried out reconnaissance missions, and, on rare occasions, dropped a few bombs. The Gotha G.1, AEG G.I and G.II battleplanes were used over the Western and Eastern Front in small numbers. While the battleplane was reliable and a good gun platform, tactically it was a failure since it could not intercept the latest enemy aircraft and in turn was easily outmanoeuvred and attacked.

In retrospect it took a surprisingly long time for the battleplane's true worth as a bomber to be recognized. But in 1915-1916 the emphasis was

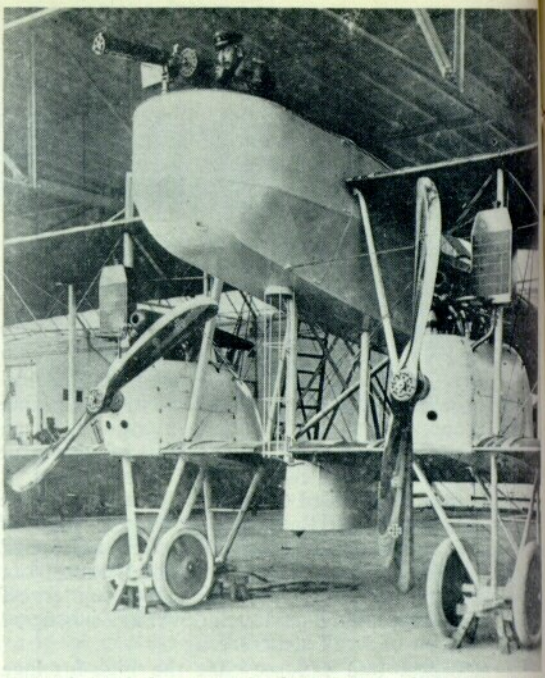
Gotha UWD, the seaplane version of the G.I. Note the black German Navy identification streamers on the wingtips. UWD indicated Ursinus Wasser Doppeldecker, *Ursinus Sea Biplane.* (Photo: E. Krüger)

centred on the immediate needs of the armies at the Front and production of artillery spotting and reconnaissance aircraft took preference. As the war continued greater specialization forced the development of specialized aircraft including bombers. Those built by Gotha, AEG and Friedrichshafen were the most successful and were eventually produced in large numbers.

In late 1915, as the last G.I's were being completed, Gotha management authorized Burkhard to prepare drawings for a new twin-engined design specifically to carry a bomb load of 300 kg. (660 lbs.) over long distances. This then was the real beginning of the much publicized Gotha bomber. Indeed all bombers that appeared over English and French cities were called "Gothas" by the Allied press although the majority of the German bombing squadrons were equipped with AEG and Friedrichshafen bombers.

The Gothas from the G.II on were entirely the work of Ing. Hans Burkhard and his small design team. Ing. Karl Rösner, often erroneously credited with developing the Gotha landplane bombers, was solely responsible for seaplane design with the exception of two landplanes he designed in 1917-1918.

The first bomber to leave Burkhard's drawing board was the Gotha G.II. It turned out to be a very successful twin-engined concept that was capable of continued improvement and remained in production in various models until the end of the war. The prototype G.II made its first flight in March 1916. It differed from the production model by having two-bay wings, an auxiliary undercarriage in front of each nacelle and a finless rudder assembly. Burkhard took into account three factors: speed, protection for the bombardier in the nose and ease of transport on flatcars. Speed was attained by keeping the wingspan small. Bombardier protection was assured by locating an auxiliary landing gear in front of each nacelle to avoid nose-overs. The axis of the main wheels was placed behind the centre of gravity. Upon touch-down the G.II immediately



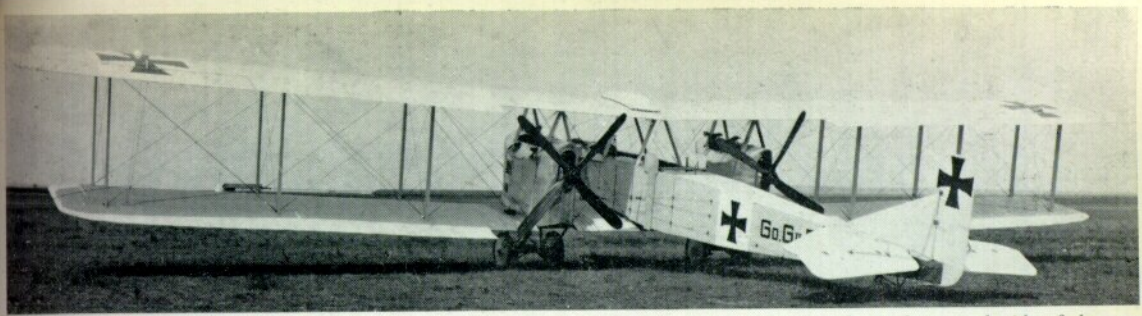
G.I with bomb-dropping tube from front cockpit and a bomb container for vertically-hung Carbonit bombs under the wings. Photo: E. Krüger)

rotated onto the auxiliary landing gear and continued its run on all eight wheels. Ease of transport was achieved by an airframe that could be disassembled into three parts: wings, nacelles and fuselage centre section and rear fuselage. Three flatcars could carry one bomber.

The slim-fuselaged prototype was indeed very fast but its high wing loading prevented it from reaching an acceptable rate of climb with full bomb load. The wingspan was enlarged to three bays. Because aircraft wheel brakes were unknown in 1915, there was no way to halt the long landing run on the eight-wheeled undercarriage. In order to land safely on the small airfields of the time, the production version was fitted with a conventional landing gear and tail skid that acted as an efficient brake. The centre of gravity was now placed behind the undercarriage and remained so on all subsequent Gotha bombers.

The prototype and small G.II production series were powered by the geared, straight-eight 220 h.p. Mercedes D.IV engine. A four-bladed or massive two-bladed airscrew was required to absorb the power

G.II prototype with two-bay wings, four-wheeled undercarriage and simple slab rudder.



Gotha G.II 204/16 production version here fitted with four-bladed propellers. The paddle-shaped guards on each side of the rear cockpit protected the gunner from debris kicked up by the wheels and flung inboard by the propeller, and also prevented the gunner from accidentally leaning into the airscrew arc. The aircraft is covered with unbleached fabric, note contrast with white field of the crosses.

efficiently. The crew, consisting of bombardier-gunner, pilot and rear gunner, could move about the aircraft through an open gangway on the right side of the fuselage. The slim fuselage was constructed from oak and spruce longerons, cross-braced with steel cable and wire and covered with unbleached fabric. The nose section was plywood skinned. The wings were of standard wood and fabric covered construction. The trailing edges were deeply cut-out for propeller clearance. The tail surfaces were built of light-gauge steel tubing and fabric covered. The engine nacelle and undercarriage were an integral structure. In the factory, the engine nacelle could be rolled into assembly position on its undercarriage. (Patent 349,065 awarded 7th February 1916). The rather bulky nacelle enclosed fuel and oil tanks mounted underneath the engines. A gravity tank was mounted on the top of the wing centre section. Initially the bomb bay for fourteen 10 kg. (22 lbs.) bombs was located in the fuselage. As the size of the bombs and the bomb load increased, bombs were carried externally on interchangeable racks attached to the bottom and sides of the fuselage. The G.II was armed with two machine guns.

The production prototype G.II was thoroughly tested in accordance with stringent air service regulations and passed its type-test (*Typenprüfung*) in April 1916. While the prototype was being tested and approved, a small production batch (serial numbers G.200/16 to 209/16) was under way. The first production G.II left the works on 25th April 1916. Machine G.201/16 was again exhaustively tested in June and July before being approved for issuance to operational squadrons in September-October 1916. The front-line complement chart shows that probably all the G.II bombers were used at the Front if one accounts for attrition. The poor reliability of the Mercedes D.IV engine which suffered from recurrent crankshaft failures and the availability of more powerful engines contributed to the early withdrawal from service of the G.II.

Gotha G.II's 203/16, 205/16 and 200/16 lined up in front of the Gotha factory. The massive two-bladed propeller was characteristic of the Mercedes D.IV geared engine.

To rectify the engine problem and incorporate other improvements, the Gotha G.III was placed into production hard on the heels of the G.II. Twenty-five G.III bombers (serial numbers G.375/16 to 399/16) were ordered and they arrived at the Front with the G.II. Records show that the G.III was type-tested in April 1916 which meant perhaps that the original G.II qualification was considered sufficient to sanction this virtually identical machine for service use. The G.III differed primarily in having the reliable and more powerful six-cylinder 260 h.p. Mercedes D.IVa engine, a stronger fuselage and a third machine gun. This gun, mounted on the floor of the rear cockpit, could fire downwards through a large opening cut into the fuselage.

The G.II and G.III were flown by *Kagohl 1* on the Balkan Front, stationed at Hudova. Here they were particularly successful. One noteworthy accomplishment was the destruction of the strategically important railway bridge over the Donau at Cernavoda

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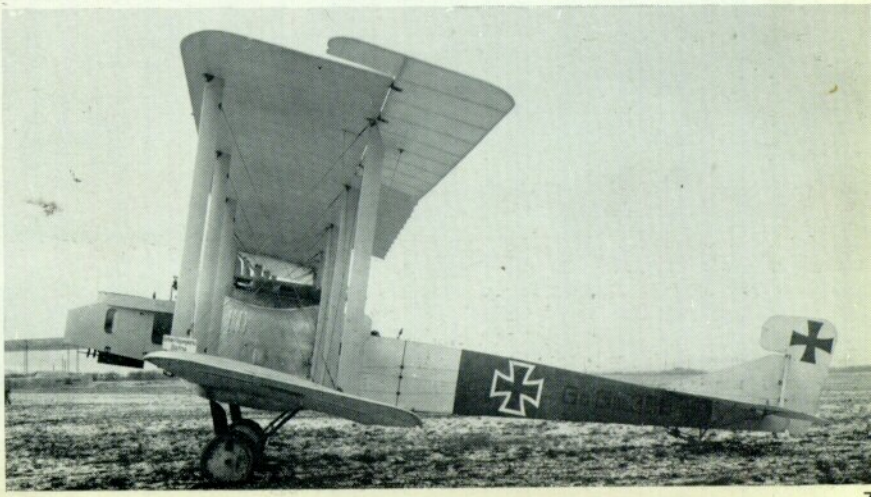
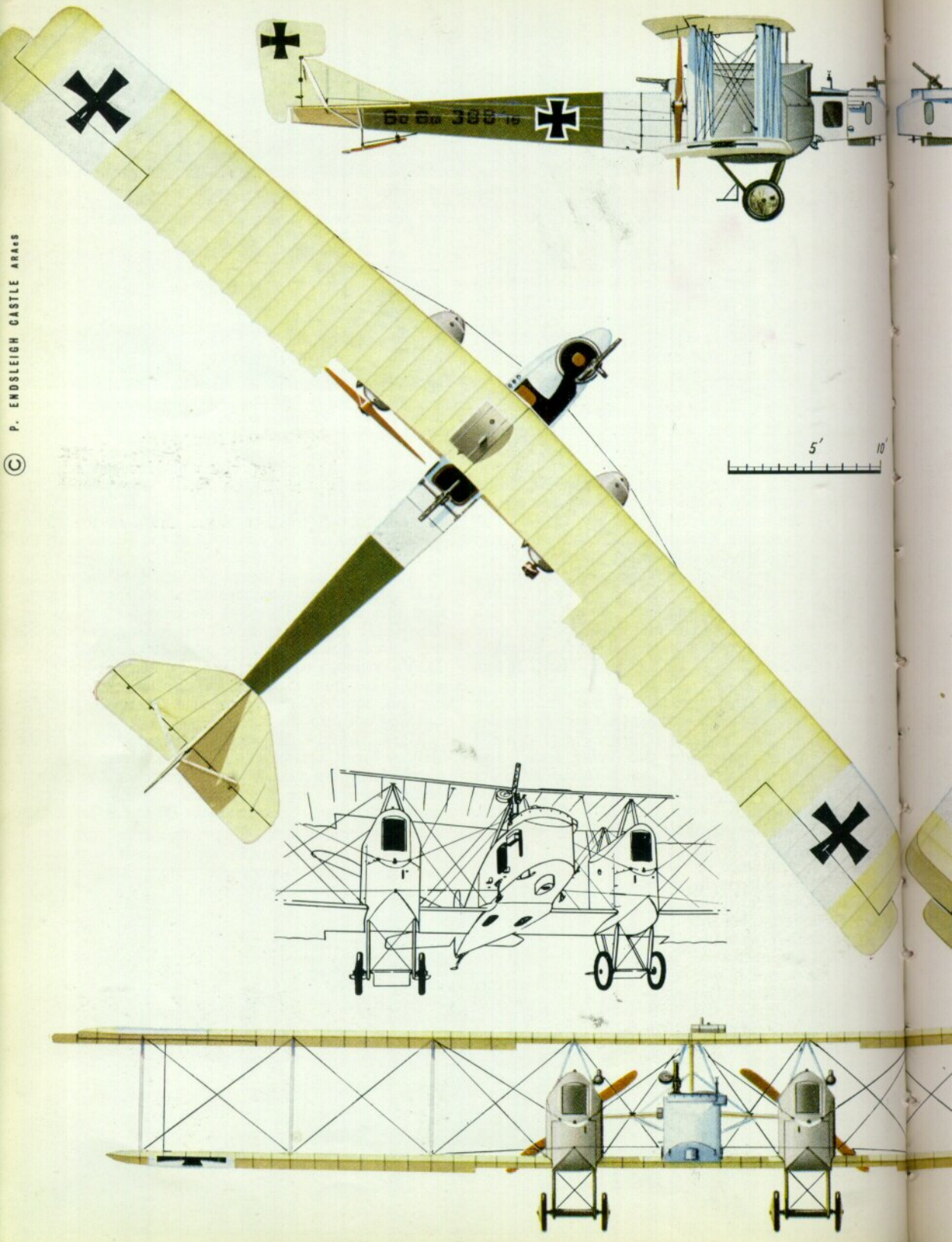
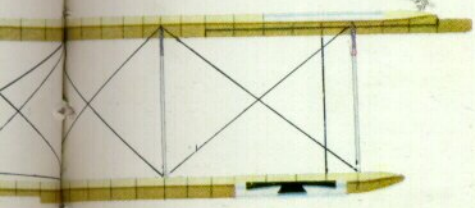


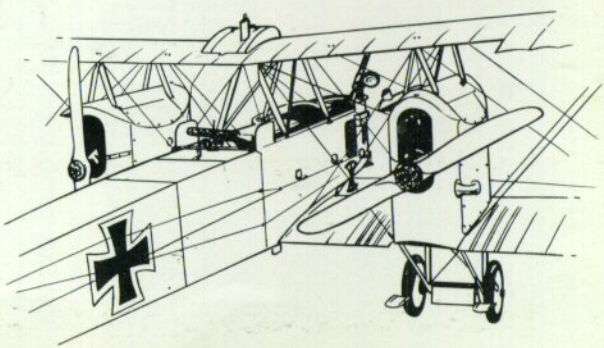
G.III, 398/16, the second to last G.III produced. The square protrusion under the front cockpit is a windscreen for the Goerz bomb sight.



Detail of fuselage lettering.

GOTHA G. III 398/16. The penultimate G.III produced.





G.III 378/16 in flight; note the reversed white-on-black crosses under the wings. (Photo: E. Krüger)

(late September 1916) which denied the Rumanians vital supplies and reinforcements. The success of these bombing missions served as an impetus to increase bomber production.

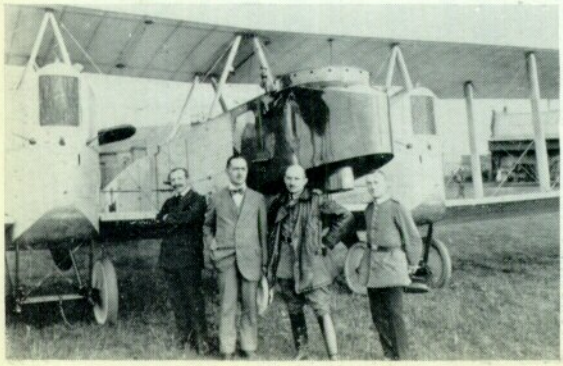
The G.III was used by *Kagohl 2* on the Western Front. In late 1916, Burkhard recalls arriving in Freiburg, where *Kagohl 2* was based, just as the squadron commander was dispatching an angry note to Berlin to complain that within a quarter hour every single-engined escort machine was left far behind the G.III.

High speed did not prevent the great French ace, Guynemer, from catching a G.III. He shared his 31st victory with Adj. Chainat when they teamed up to down a *Kagohl 2* G.III in the St. Michiel sector on 8th February 1917. The crew was made prisoner before they could set fire to their machine. It became the subject of intensive study by French experts at St. Cyr.

Another G.III fell into British hands on 23rd April 1917 at Vron. The Germans claimed it was a victim of flak but the British credited the victory to Sub. Lt. L. S. Breadner of No. 3 Naval Squadron. Although almost completely burned by its crew, it was investigated by British technical intelligence under captured enemy aircraft number G.23.

By the end of 1916 it was obvious that the Zeppelin attacks on England were a costly failure. Spurred on by long nourished hopes and armed with new long-range weapons, the German Army air staff now made extensive preparations to bomb England with Gotha and Giant bombers. This action was code named *Türkenkreuz* (Turk's Cross). The bombers chosen for this task were the new Gotha G.IV, just coming into service, and the Giant bombers, primarily those built by Staaken which were expected at the Front in the near future.

G.II production prototype. Standing in foreground are Ing. Hans Burkhard (with bow tie) and Gotha test pilot Schliefel (in leather flying jacket). (Photo: Burkhard)



Thirty-five Gotha G.IV bombers were on order in November 1916 and this was increased to fifty in February 1917. The probable serial numbers were G.401/16 to 412/16, G.600/16 to 624/16 and G.649/16 to 663/16; it is believed that some numbers in the last batch were assigned to G.V prototypes. Official records list two type-test dates for the G.IV: April and December 1916. Perhaps the earlier date referred to the prototype and it may be this machine that was the solitary G.IV at the Front in December 1916. It was not unusual for Germans to send prototype machines to the Front for combat evaluation. The December type-test most likely applies to the G.IV production series.

Daylight bombing missions had demonstrated the need for stronger, more flexible defences beneath the tail and the G.IV was designed in response to this requirement. In an attempt to find a solution to this vexing problem, Burkhard designed one Gotha with the rear deck cut away, forming an inverted triangle, to give the rear gunner an increased downwards field of fire with the top rear machine gun. The designation of this machine is not known, but it exhibits features of both the G.III and G.IV and certainly was the G.IV forerunner. It may indeed have been the single G.IV that was at the Front in December 1916.

However the dead zone below the aircraft was still too large and the lower machine gun too awkward to handle efficiently in heat of combat. Burkhard's solution was very clever. He simply hollowed out the lower rear fuselage from the rear gunner's position back to the tail. A small triangular opening in the top deck allowed the rear gunner to shoot down with the top machine gun. If he had time, or if in rare instances another crew member was carried, he could use the gun mounted on the floor of the rear cockpit. The tunnel provided a far larger field of fire for both top and bottom guns and was far easier to use than the simple opening in the G.III. The arrangement was known as the Gotha Tunnel and it surprised many an unsuspecting Allied pilot who felt safe in attacking from below. In 1918 the Friedrichshafen G.IIIa bomber was also equipped with a tunnel to defend against growing night fighter attacks.

The G.IV could carry a maximum of four machine guns although two or three were the norm. The

NUMBER OF GOTHA BOMBERS AT THE FRONT 1915/1918

YEAR	1915		1916						1917						1918				
Date	31 Oct	31 Dec	28 Feb	30 Apr	30 Jun	31 Aug	31 Oct	31 Dec	28 Feb	30 Apr	30 Jun	31 Aug	31 Oct	31 Dec	28 Feb	30 Apr	30 Jun	31 Aug	31 Oct
G.I	5	6	1	—	1	1	1	—	—	—	—	—	—	—	—	—	—	—	DATA NOT AVAILABLE
G.II	—	—	—	—	—	—	4	3	1	1	—	—	—	—	—	—	—	—	
G.III	—	—	—	—	—	—	7	14	3	4	3	3	—	—	—	—	—	—	
G.IV	—	—	—	—	—	—	1	—	—	30	36	34	35	19	10	8	6	5	
G.V	—	—	—	—	—	—	—	—	—	—	—	3	20	33	34	36	15	8	
G.Va	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11	19	4	
G.Vb	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21	

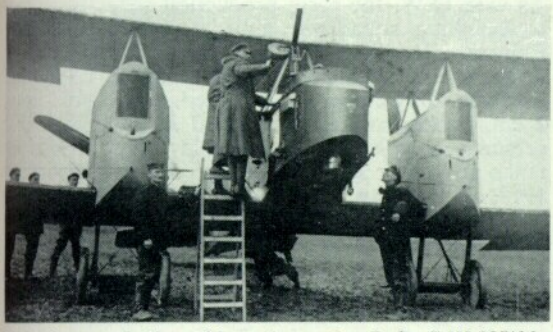
fourth gun, operated by a fourth crew member, was mounted on a tall pivot located on the deck between the bombardier and pilot. This arrangement was rarely used because it meant that the bomb load would have to be reduced accordingly.

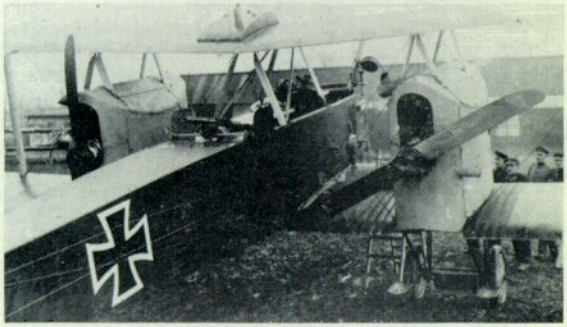
The major visible difference of the G.IV was that ailerons were fitted to upper and lower wings and connected by a strut. The fuselage was completely plywood covered to provide additional strength around the tunnel. The all-plywood fuselage was semi-waterproof and theoretically could float for several hours.

Thirty bombers were to be ready on 1st February 1917 to begin the *Türkenkreuz* attacks on England, but mass production was delayed owing to the scarcity of construction materials and the failure of the first production machines to fulfill performance requirements. The G.IV did not go into squadron service until March-April 1917 and then it took another month before the commander of *Kampfgeschwader 3* (later renamed *Bombengeschwader 3*) felt ready to start against England. The *Kagohl 3* airfields were St. Denis-Westrem and Gonterode; later pressure of almost nightly bombing by the British forced *Kagohl 3* to shift to Mariakerke and Oostacker. All were in the vicinity of Ghent.

During practice missions it was discovered that all the engine bearings were defective, so new engines had to be installed. The main tanks could not be completely emptied due to a faulty fuel line system. This had to be corrected. The fuel was insufficient to reach London and a second gravity tank was installed on the top wing of the G.IV. Prior to this modification it was customary for the G.IV's to land at Nieuwmunster near the Belgian coast to top off the tanks before continuing. Prevailing winds were stronger than expected.

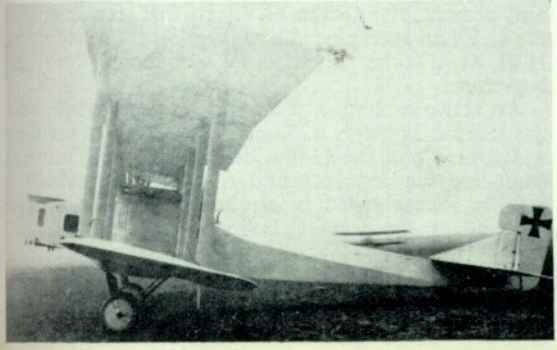
On 25th May 1917, twenty-three Gotha G.IV bombers of *Kagohl 3* took off on the first of eight daylight raids against England, including two on

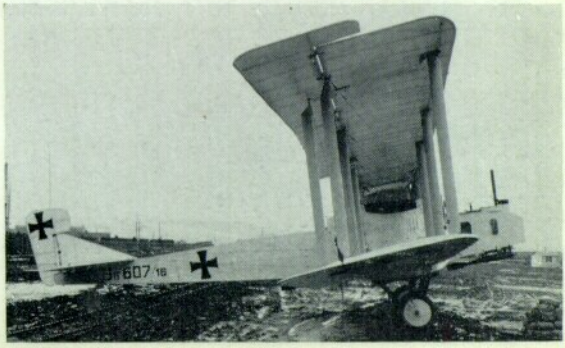


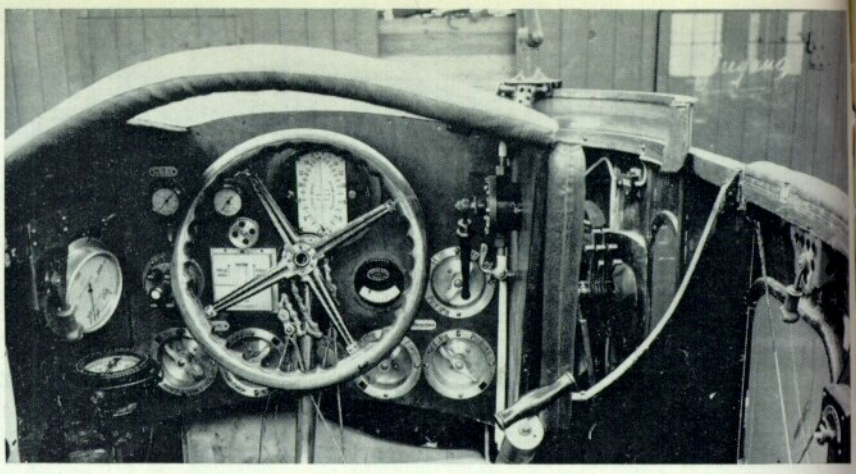


Left: *Interested pilots of* Jasta 4 *examine Gotha G.III 397/16 at Marchais in May 1917. The slim fuselage and* Cellon *windows on the side of the front cockpit are here evident.* Right: *G.III 397/16; the passageway on the right side of the fuselage connects the front and rear cockpit; the rear gun is mounted on a lateral slide rail; and mudguards on the wheels prevent stones being thrown into the propeller arc.* (Photos: W. Puglisi)

Left: *An interim type between the G.III and G.IV with cutaway rear fuselage to provide the rear gunner with a better field of fire.* Right: *Gotha G.IV of the second batch; with these aircraft* Kagohl 3 *began the attacks on England. Note externally mounted bombs under the nose and centre-section.*







Pilot's controls in the G.IV. The Cellon *window above the controls provides illumination; the cut-out to starboard for the passegeway is clearly visible, and through it can be seen the bomb-release levers in the forward cockpit.*

London. This opened a new dimension in strategic warfare (*). By September 1917, greatly improved British defences and severely reduced performance of the Gothas, particularly attack altitude, forced *Kagohl 3* reluctantly to switch to night attacks.

By this time both Siemens and LVG-built G.IV's were serving with *Kagohl 3*. The Gotha factory was not capable of producing the quantity of bombers needed to keep the England Squadron at full strength. In December 1916, SSW (Siemens-Schuckert Werke) received an order for eighty Gotha G.IV(SSW) bombers (serial numbers G.1055/16 to 1094/16 and G.200/17 to 239/17) to be produced in the SSW Berlin factory. LVG (Luft-Verkehrs-Gesellschaft) received an order for about 100 Gotha G.IV(LVG) bombers also built in Berlin (serial numbers G.980/16 to 1029/16 and an unidentified 1917 batch). The G.IV(SSW) passed its type-test in April 1917 and the G.IV(LVG) in June 1917. Because *Idflieg* specified a strengthened airframe, which increased weight considerably, the performance of the license-built G.IV never matched that of the original G.IV.

Of the first SSW batch, seventeen bombers were delivered to *Kagohl 3*, the remainder to *Kagohl 2* and *Kagohl 4* and to the squadron school at Paderborn in the period between July 1917 and February 1918. The second SSW batch was delivered between December 1917 and August 1918 mainly to bombing and squadron schools as trainers since the G.IV was, by then, obsolete for combat work. Most of the trainers were powered by 185 h.p. NAG C.III or 180 h.p. Argus As.III engines, the lower horsepower being adequate for training purposes. The fuel tanks were shifted to the fuselage to lessen the fire hazard during crashes.

A number of the SSW machines were drastically modified in attempts to improve performance. The G.210/17 was powered by two 245 h.p. Maybach Mb.IVa engines driving tractor propellers; G.212/17 had its wingspan enlarged by adding another bay; G.213/17 and G.214/17 had a special Siemens rib profile and G.227/17 was equipped with an experimental, Siemens-developed supercharger. The war was over before it could be fully tested. Virtually all of the second series had an auxiliary landing gear (*Stossfahrgestell*—shock landing gear) mounted on the fuselage nose and Flettner servo-rudders on the ailerons. Originally developed for guided missile control, the Flettner servo-rudder was installed on all German bombers in late 1918 to relieve the pilot of heavy control forces.

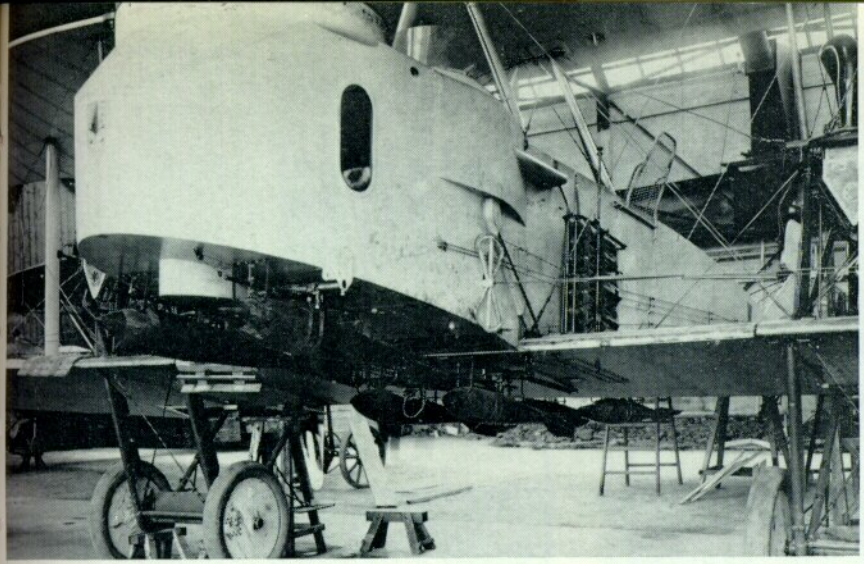
Rare view of the G.IV with the SSW-developed Stossfahrgestell. *Due to the rubber shortage this training aircraft had wooden wheels.* (Photo: E. Krüger)

Deliveries of the G.IV (LVG) started in July 1917. A report distributed to both Gotha and SSW stated that the tail heaviness of the LVG-built G.IV had been eliminated by increasing the sweepback of the wings. As with SSW, the early production series were sent to bombing squadrons and later models became trainers. The first trials with Flettner rudders and Argus engine installations were made on LVG-built bombers. In October 1917, a fixed, downwards-firing 2 cm. Becker cannon was tested in an G.IV(LVG) presumably to experiment with low-level attacks on tanks and other ground targets. Starting February 1918, about thirty LVG-built G.IV's, powered by the Austrian 230 h.p. Hiero engine, were delivered to Austria. Austrian serial numbers 08.02, 08.07, 08.11 and 08.20 have been identified. The G.IV (LVG), armed with Schwarzlose machine guns, was used in combat against the Italians. As usual, the Austrians were given German aircraft that were no longer suitable for combat on the Western Front.

In early 1917, with SSW and LVG beginning to produce G.IV bombers for summer and fall delivery and with the G.IV production starting to taper off at the Gotha factory, Burkhard was working on a G.IV replacement, the Gotha G.V. In fact, the order for the G.V had been placed by *Idflieg* on 14th November 1916 at a time when G.IV deliveries were just beginning.

An active exchange of information existed between the technical officers of *Kagohl 3* (and other bombing squadrons) and the Gotha design staff. As a result, front-line requirements and modifications could be quickly incorporated in aircraft on the production line and on the drawing board.

* For a full and authoritative account of the Gotha raids on England see Major Raymond Fredette: *The Sky on Fire*. New York. Holt, Rinehart and Winston. 1966 (July-August), and published in Great Britain as *The First Battle of Britain 1917/1918*. London: Cassell. 1966 (May-June).



A G.IV at the factory with externally mounted bombs below on the fuselage side. The bulged fairing on the port side of the cockpit contained the throttles; the actuating arms can be seen running diagonally down to the wings.

The Gotha G.V, developed in part to specific demands and suggestions of *Kagohl 3*, represented the latest thinking in German long-range bomber design. It leaned closely on the G.IV. The major difference was the transfer of the fuel tanks away from the nacelles into the fuselage. The nacelle-mounted tanks had a serious tendency to burst during crashes and spray highly inflammable petrol over the hot engines. This caused needless casualties and it was hoped that relocating the tanks would minimize this danger. The engines were enclosed in streamlined nacelles mounted between the wings. Bombs were hung externally under the wings and fuselage. To reduce weight to a minimum, Burkhard very carefully engineered the airframe to make it lighter and stronger than the G.IV.

The G.V passed its type-test in July 1917 and the first production machines reached *Bogohl 3* in August 1917. It was initially hoped that the new Gotha would enable the squadron to renew daylight attacks on London in September 1917. But even the G.V was not considered powerful enough to evade tenacious and determined British defences during daytime. As a matter of fact the performance of the G.V was not really superior to the G.IV and the slightly higher speed was bought at the expense of a lower rate of climb. The German aircraft industry at this juncture was heavily strained to meet the exacting material needs of *Amerika Programm*. Unseasoned lumber (it took five years to properly dry wood, kiln drying being unknown at the time) and extra equipment increased the empty weight of the G.V some 400 to 450 kg. (880 to 990 lbs.) over the design specifications. In addition the horsepower rating of the engines was about 15 h.p. less due to the low quality fuel. This had a drastic effect on performance.

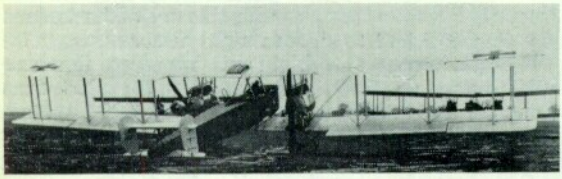
Tests had shown that with every 1% increase in operational weight the ceiling was reduced by 60 to 80 metres (197 to 252 feet). For instance, the early production G.IV's at first had an excellent climb (5,500 metres in one hour) but with supplementary wing tanks, reinforced airframe and extra operational equipment (i.e. oxygen apparatus, navigational instruments, generator for heating clothing, ammunition and messenger pigeons in case of being forced down at sea), the G.IV was forced to fly with an overload of 140 to 160 kg. (308 to 352 lbs.). On the first England raid the average attack altitude was 4,900 to 5,100 metres (16,000 to 16,700 feet), on the second 4,500 to 4,900 metres (14,700 to 16,100 feet) and on the third 3,800 to 4,100 metres (12,400 to 13,400 feet). This was proof of the penalty paid for poor fuel and increased weight. The steady deterioration of attack altitude was one of the reasons why *Bogohl 3* had to shift to night attacks.

The first Gotha G.V night missions were flown at 2,000 metres to 2,500 metres (6,570 to 8,200 feet) while the last was flown at 1,200 to 1,700 metres (3,940 to 5,580 feet). No wonder the German aircraft industry was feverishly working to improve engine performance with superchargers and other innovations in hopes of being able to resume daylight attacks. In an attempt to increase the operational altitude of the G.V, a Maybach Mb.IVa high-altitude engine was installed but results were disappointing, primarily because of the difficulty in finding a suitable propeller shape to match engine and aircraft characteristics.

Whereas the performance of the Gothas suffered directly as a result of the British blockade and not as a fault of the designer, their flying characteristics were surpringly agile. This made it difficult to shoot them down, particularly since the tunnel gun could be brought to bear on aircraft attacking from below. The stability of the Gothas was very satisfactory with full or half load; without bombs and on empty fuel tanks it was relatively difficult to fly. Skilful piloting was required. Trained, experienced pilots were never plentiful and instruments for night flying in their infancy. Landing bombers at night was particularly tricky, especially in gusty weather and the lack of

Gotha G.IV (LVG) 08.11, supplied to Austria in 1918, powered by 230 h p. Hiero engines. Note additional centre-section strut.
(Photo: P. Bowers)

Gotha G.V 904/16 with streamlined engine struts and improved fairing of the lower wing as compared to earlier types.



Below left: Gotha G.V modified to test simplified undercarriage structure. (Photo: von Römer)

Left: One of the few known photographs of the G.Vb; the tab on the upper aileron is the Flettner servo-rudder. The machine illustrated is 935/18.

visual or instrument references made landing a hazardous adventure every time. As a matter of fact, a German report dated 18th January 1918, written when twin-engined bombers were flying mostly night missions, stated that every third German bomber was lost due to accidents.

As a result of the increased rate of landing accidents in late 1917, *Idflieg* asked Gotha to develop a *Stossfahrgestell* in the manner of the Friedrichshafen and Rumpler bombers, but a single wheel mounted under the nose proved unsatisfactory. Attemps were made to lower the centre of gravity by raising the engines 20 cm. (7·9 inches) and lowering the undercarriage a corresponding amount. This modification was not entirely satisfactory either. Finally two successful solutions were developed: A Siemens-Schuckert *Stossfahrgestell* consisting of twin wheels mounted on a tubular framework extending below the bomber's nose and an auxiliary twin-wheeled gear mounted in the front of each nacelle in the manner of the G.II. These modifications added about 100 to 200 kg. (220 to 440 lbs.) to the empty weight of the aircraft.

The Gotha G.IV and G.V bombers of *Bogohl 3* supported by the Giant bombers of *Riesenflugzeugabteilung 501* (Giant Aircraft Squadron) carried out a total of nineteen night attacks on England in the period 3rd September 1917 to 19th May 1918. In this time *Bogohl 3* also bombed targets on the Continent but a record of the total missions flown is not available. It is interesting to examine the losses of *Bogohl 3* incurred during the attacks on England. Major Fredette in his excellent work comes to the following conclusion:

Lost to fighter attacks	8
Lost to anti-aircraft fire ..	12
Engine failure over England ..	1
Crashes in Belgium	36
Missing	3
Total	60

SPECIFICATION GOTHA G.IV

Power: Two 260 h.p. Mercedes D.IVa
Propeller: Heine 310 cm. Diameter
24,5 cm. Blade Width
175 cm. Pitch

Wings:	Dihedral:	Top	174°
		Bottom	174°
	Sweepback:	Top	177° 40′
		Bottom	177° 40′
	Chord:	Top	2300 mm. (inner)
			2300 mm. (outer)
		Bottom	2180 mm. (inner)
			2140 mm. (outer)
	Area:	Top	44,18 m2
		Bottom	40,60 m2
	Angle of Attack:	Top	6°
		Bottom	6°

	Max. Length	Max. Width	Area
Fin:	995 mm.	2015 mm.	1,18 m²
Tailplane:	3900 mm.	2015 mm.	4,05 m²
Rudder:	2045 mm.	1280 mm.	1,64 m²
Elevator:	3900 mm.	590 mm.	1,68 m²
Ailerons: Top	3847 mm.	850/1350 mm.	3,20 m²
Bottom	2925 mm.	780 mm	2,17 m²

Undercarriage: Track: 1080 mm.
Tyres: 810 mm. Diameter
125 mm Width
Hub: 55 mm. Diameter
160 mm. Width

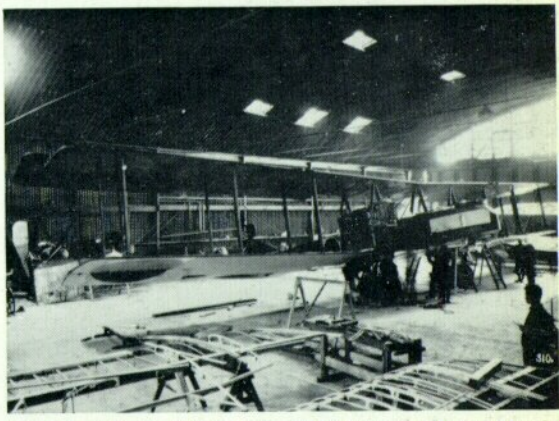
Fuel: Tank 1—275 litres
Tank 2—275 litres
Gravity Tank—70 litres
Oil: Engines—30 litres
Tanks—60 litres

Radiators: Windhoff—66 litres water for both radiators

Weights:

Useful Load	1235 kg.
Weight Empty (without fuel and water)	2337,20 kg.
Water	76 kg.
Weight Loaded (without fuel)	3648,20 kg.
Useful Load: Crew (3)	245
MG	130
Bombs	300
Fuel	508
Free	52
	1235 kg.
Fuselage	359,20
Fuselage Fittings (struts, seats, belts, pulleys, cables, etc.)	68
Undercarriage & Tail Skid	167,50
Wings	506
Control Surfaces	21
Engines	820
Exhausts	27,10
Starter	4,50
Fuel Tanks	88,50
Gravity Tanks	24,50
Oil Tanks	20
Propellers	67
Engine Accessories and Gauges	36,90
MG and Bomb Racks etc.	57
Total	2337,20 kg.

Gotha G.IV's. 624/16, 604/16 "K" and 603/16 "MS" preparing to take off from Nieumunster. (Photo: H. Fischer)



Left: *The bomb rack for a single Carbonit bomb under the wing of a Gotha G.I.* (Photo: W. Puglisi) Right: *Gotha taken over by the Netherlands air service, seen here in Dutch markings in the L.V.A. workshops. The fin serial is 'LA 50'.* (Photo: G. H. Kamphuis)

The upper gunner of a G.Va demonstrating the downward-firing capability of his Parabellum machine gun, aiming down through the rear fuselage under-surface cut-out. Note excellent clarity of details of engines and fabric skinning.

It is evident that the rigors of night flying, the formidable task of mastering the large aircraft by inexperienced pilots and the hazards of night landing were important factors in contributing to the non-combat losses. *

* Neither British or German official histories take into account the aborted raid of 18th August 1917, known as the *Hollandflug* or *Hollandfilm*, with its disastrous losses. The Dutch definitely brought down two Gothas, many crashed in Belgium and some came down at sea.

The England raids ceased because of both military and political considerations. *Bogohl 3* bombers were used on the Western Front to attack tactical targets during the great German spring offensive of 1918, and later to hamper Allied offensive efforts. The Gothas flew at night on relatively short missions, often several per night. Reduced fuel quantities made it possible to carry a heavier bomb load. By June 1918, the G.V's use at the Front was beginning to taper off and it was being replaced by the G.Va and G.Vb versions.

It is difficult to differentiate between the G.Va and G.Vb on photographs. Confusion exists between the various R.A.F. intelligence reports as the chart below shows and positive identification of photos is impossible unless the designation can be read on the aircraft.

Obviously World War I aircraft were readily modified and running changes could easily be made on the production line. Perhaps this explains the many variations of the late Gothas, as Germany fought to overcome material shortages by design innovations.

While Allied technical intelligence documents are not in agreement, and indeed they may be entirely correct, it is safe to say that the chief characteristic of the G.Va and G.Vb was the twin rudder and tailplane arrangement. By placing the rudder in the propeller slipstream, *full*-powered, single-engined flight in a straight direction was possible. The smaller area of the box tail also increased the rear field of fire. The G.Va and G.Vb had a shorter nose than the G.V; a half-opened machine gun ring and one of the two types of *Stossfahrgestell*. Some aircraft were fitted with Flettner servotabs on the ailerons.

The box tail was tested in February 1918 on the prototype G.Va. After some slight modifications, the G.Va went into production in March and by April eleven machines were already at the Front. It was produced in small series until June 1918, when it was replaced on the production line by the G.Vb.

The G.Vb represents the ultimate development achieved by the classic Gotha design. As far as can be determined the only difference between the G.Va and the G.Vb were internal. These changes made it possible for the G.Vb to carry a useful load of 1,600 kg. (3,520 lbs.), an increase of 365 kg. (803 lbs.) over previous types. Twenty-one of these bombers were at the Front in August 1918 and it is estimated not more than thirty were built before production shifted to newer types at Gotha. The total number of Gotha G.V bombers built, in all versions, is not known. A rough guess based on serial numbers would place the total at somewhere around 200, all built by Gotha. Provisional serial numbers of the G.V are: G.664/16 to 677/16, G.900/16 to G.979/16, G.655/17 to 666/17 and G.930/17 to 979/17; G.Va: G.700/17 to 723/17 and G.Vb: G.930/18 to 935/18.

Gotha went on to build fast, high-altitude reconnaissance and bomber machines: the G.VII and G.VIII designed by Rösner and the G.X designed by Burkhard. It was planned to resume daylight attacks on England in 1919 with these new bombers and heavily armed, all-metal Giants. Burkhard also built the world's first asymmetric aircraft, the Gotha G.VI bomber, but the war ended before it could be fully evaluated. In all the Gothaer Waggonfabrik built about 300 bombers and about 280 aircraft of other categories during the First World War. After the war, Gotha constructed railway tank cars until 1933 when it took up aviation again to supply trainers and gliders to the new German air force.

The author would like to express his gratitude for the willing assistance and thoughtful criticism given by Ing. Hans Burkhard, Egon Krüger, A. E. Ferko, Gustav Ewald, Major R. Fredette and the U.S. Air Force Museum.

COMPARISON OF THE GOTHA G.Va and G.Vb

Reported Type	G.Va 706/17	G.Va 723/17	G.Vb	G.Vb 935/18
By Whom	R.A.F. Intelligence	R.A.F. Intelligence	R.A.F. G/1 Bde/12	Photo
Date	20/21st July 1918	4/5th July 1918	10/11th Aug. 1918	
Place	Dunkirk	Crochte	Caucourt	
Tail Unit	Standard *	Box Type	Box Type	Box Type
Main Undercarriage	Four-Wheeled	Two-Wheeled	Four-Wheeled	Four-Wheeled
Nose Auxiliary Gear	None	Two-Wheeled	None	None
Flettner Rudder	No Data	Yes	No	Yes

** This machine was badly damaged and it is possible that the date given here is in error.*

GOTHA BOMBERS, DIMENSIONS, WEIGHTS AND PERFORMANCE

SPECIFICATION	G.I	G.II	G.III	G.IV	G.IV (SSW) 1055—1078/16	G.IV (SSW) 1079—1094/16	G.IV (SSW) 210/17	G.IV (SSW) 210/17	G.IV (SSW) 212/17	G.IV (LVG) 993/16	G.V 666/16	G.Va	G.Vb
Powerplant (Horsepower & Type)	160 D.III	220 D.IV	260 D.IVa	260 D.IVa	260 D.IVa	260 D.IVa	245 Mb.IVa	185 C.III	260 D.IVa	260 D.IVa	260 D.IVa	260 D.IVa	260 D.IVa
Span, Upper m.	20,3	23,7	23,7	23,7	23,7	23,7	24,9	24,9	28,20	23,7	23,7	23,7	23,7
Lower m.	19,7	21,9	21,9	21,9	21,9	21,9	—	—	—	21,9	21,9	21,9	21,9
Length m.	12,1	12,2	12,2	12,2	12,2	12,2	12,2	12,2	12,2	12,2	12,2	—	—
Height m.	3,7	3,9	3,9	3,9	3,9	3,9	3,9	3,9	3,9	3,9	3,9	3,9	3,9
Wing Area m^2	82,0	89,5	89,5	89,5	84,78	84,78	88,9	88,9	100,7	89,5	89,5	89,5	89,5
Empty Weight kg.	1800	2180	2383	2413	2554,6	2621	2621	2505	2621	2265	2740	2740	2950
Gross Weight kg.	2800	3190	3618	3648	3789,6	3856	3856	2905	3856	3500	3975	3975	4550
Max. Speed kmh.	130	135	135	135	135	120	—	125	120	135	140	140	135
Ceiling m.	2700	—	—	5000	4500	4600	—	—	4000	—	6500	—	—
Duration hrs.	4	4	3¾	3¾–6	3¾–6	—	—	—	—	—	—	6	—
Range	—	—	—	—	—	—	—	—	—	—	—	—	—
Crew	2–3	3	3	3	3	3	3	3	3	3	3	3	3
Machine Guns	1	2	2–3	2–3	2–3	2–3	2–3	2–3	2–3	2–3	2–3	2–3	2–3

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