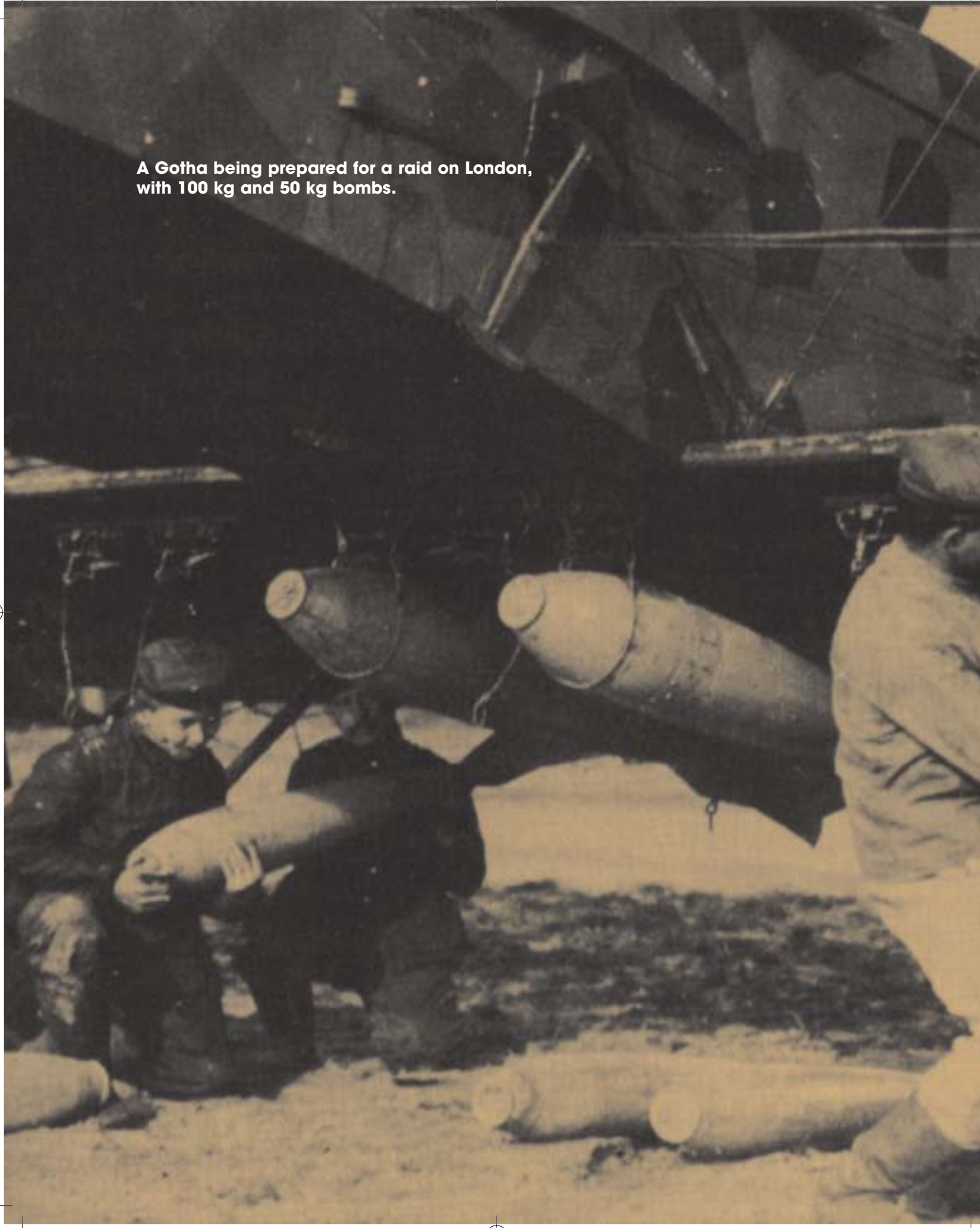
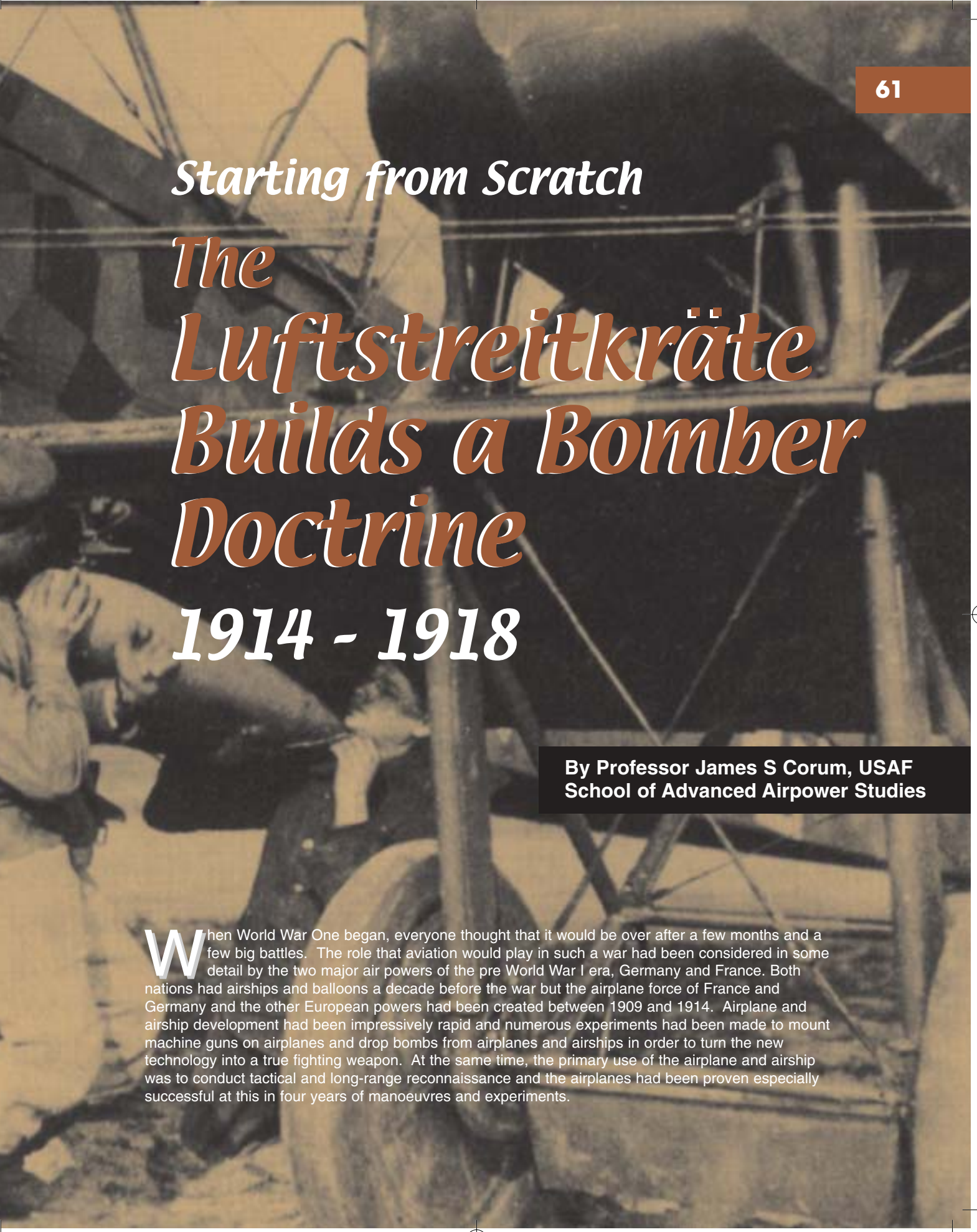


A Gotha being prepared for a raid on London, with 100 kg and 50 kg bombs.



Starting from Scratch

The Luftstreitkräfte Builds a Bomber Doctrine 1914 - 1918

By Professor James S Corum, USAF
School of Advanced Airpower Studies

When World War One began, everyone thought that it would be over after a few months and a few big battles. The role that aviation would play in such a war had been considered in some detail by the two major air powers of the pre World War I era, Germany and France. Both nations had airships and balloons a decade before the war but the airplane force of France and Germany and the other European powers had been created between 1909 and 1914. Airplane and airship development had been impressively rapid and numerous experiments had been made to mount machine guns on airplanes and drop bombs from airplanes and airships in order to turn the new technology into a true fighting weapon. At the same time, the primary use of the airplane and airship was to conduct tactical and long-range reconnaissance and the airplanes had been proven especially successful at this in four years of manoeuvres and experiments.

The reconnaissance mission of the airplane was certainly important for obtaining the operational edge over the enemy in the expected grand campaigns and almost all of the aircraft of the German Army were specifically assigned to support armies and army groups. The priority for good information for the ground armies in turn pushed the development of suitable aircraft for the mission. The reconnaissance aircraft (almost all planes) favoured by Germany in 1914 was a sturdy, fairly fast (100mph), manoeuvrable two-seat biplane with a moderate range. Such aircraft could take off from rough landing fields near the army headquarters, fly up to 40 miles behind the enemy lines, observe enemy troop deployment and movement and return to army headquarters with the information. Such light aircraft could be fitted with a few light bombs dropped by the observer, but had little capability to contribute directly to combat operations in 1914.

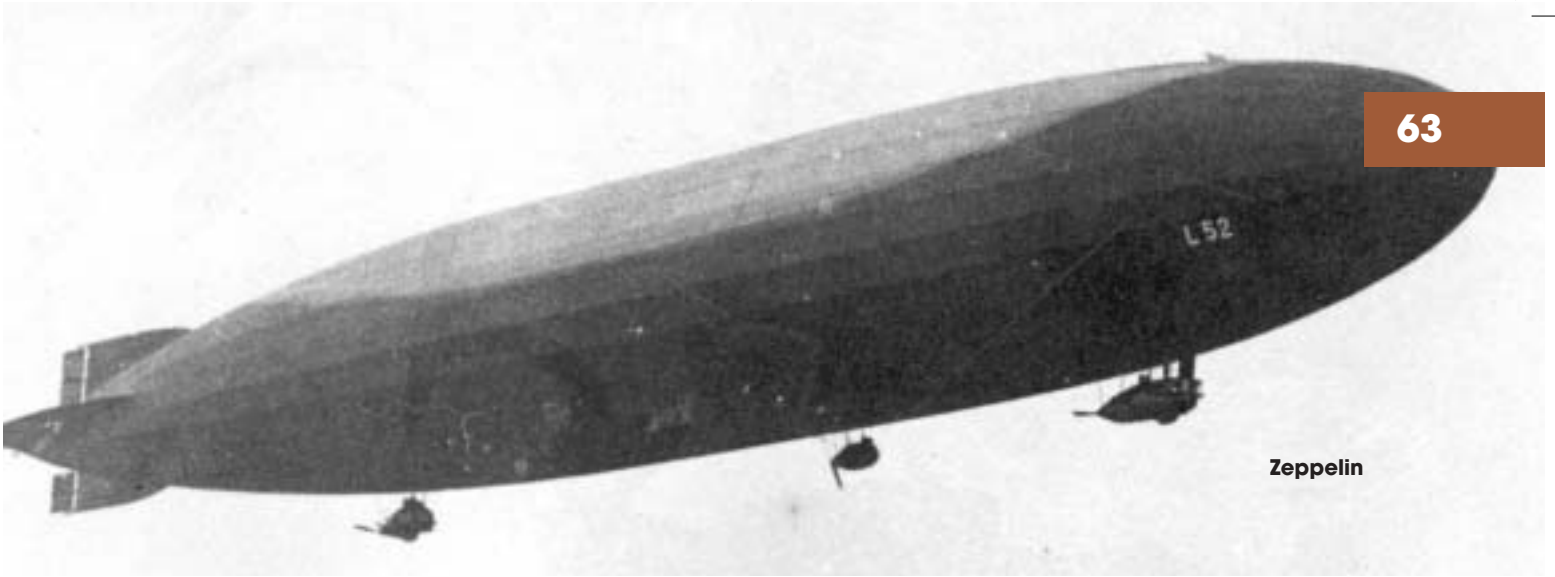
Yet, in the Fall of 1914 little happened as anticipated. On the Western Front the great powers became locked in a bloody stalemate. On the Eastern Front the Germans had delivered a sharp blow to the Russians at Tannenberg but the Russians still had a huge army and was still a grave threat to Germany. In short, Germany had to look at the prospects of a long war. German airmen began to think in earnest about developing a bomber force that could drop heavy bombs deep behind the enemy lines upon vital targets that would disrupt the enemy war production, demoralise his population and damage the logistics upon which the field armies relied.

Within two and a half years Germany built up a heavy strategic bomber force capable of striking a serious blow against the British homeland. Moreover, Germany had built up a bomber force on every front capable of attacking a variety of operational targets. It was a remarkable technological accomplishment. However, even the most impressive weapons need some kind of explicit concept of employment in order to be used with real effectiveness. During the first two years of the war the German Army developed a fairly sophisticated doctrine for employing its heavy bomber force. During the 1917–1918 campaign against British and French cities, the Luftstreitkräfte (Imperial Air Service) learned a good many technological and tactical lessons and continued to refine its doctrine during the last two years of the war. By the end of the war, the Imperial Air Service had matured into a genuine modern air force with a comprehensive view of all aspects of aerial warfare to include anti-aircraft defence, reconnaissance, close air support of ground troops and strategic bombing.

PRE-WORLD WAR ONE DOCTRINE

Although aviation was a new arm in the German army it had already attracted a disproportionate number of the best and brightest officers into its ranks. In 1911, right after the army's first fatal flight accident, more than 900 army officers applied for flight training.[1] Several very talented General Staff officers were posted to the Aviation Branch between 1910–1914 to include Majors Hermann von der Lieth-Thomsen, Wilhelm Siegert, and Lieutenants Wilhelm Haehnelt, Helmuth Wilberg and Hugo Sperrle. By the outbreak of the war two to three dozen of the army's general staff corps had joined the aviation force out of a total General Staff corps of only 622 officers.[2]

From the early days of aviation the German General Staff showed a great deal of interest in the possibilities of using the aircraft as a bomber and fighting machine. From the establishment of a small air arm in 1910, the General Staff lobbied the Prussian War Ministry (which controlled the funds and procurement) for funding for military aviation. The Chief of the General Staff, General von Moltke, showed great interest in experiments with dropping bombs and mounting machine guns on airplanes. In a letter to the Army Transportation Inspectorate in September 1912 Moltke wrote, 'I am placing great emphasis upon determining what is the largest weight that can be safely dropped from different aircraft models.'[3] From 1912 to 1914 several tests were done with bombing and mounting guns on aircraft and



Zeppelin

A means had to be found to attack the British economy and political will – and the means available were the Zeppelin and the submarine

the general staff closely followed the results as they fought to rapidly increase the size of the aviation arm of the army.

GENESIS OF STRATEGIC BOMBING

Once the war had settled into a stalemate in the Autumn of 1914 the General Staff had to develop a long-term plan for prosecuting the war. The General Staff understood that Great Britain was the economic and political centre of gravity for the Allied powers. While Britain's ground force contribution, at this point in the war, was fairly small, Britain's enormous industrial power and financial might was the key to keeping the Allies in the war. Without Britain's money and industry, France and Russia could not expect to win against German power in the long term. Moreover, Britain's navy gave her the ability to attack Germany's weaker allies such as the Ottoman Empire. Yet Britain was virtually invulnerable from direct attack. A means had to be found to attack the British economy and political will – and the means available were the Zeppelin and the submarine.

In late 1914 Wilhelm Siegert, a general staff officer who had served in the Aviation Inspectorate and commanded an aviation battalion, won the approval from the High Command to create a special bomber force that would operate not as part of a field army's aviation force, but would serve under the direct command of the High Command. The unit, given the cover name of 'Carrier Pigeon Detachment – Ostend' (Brieftauben Abteilungen Ostende), was to be an elite force based in recently occupied Flanders with the eventual mission of attacking Britain by means of aerial bombardment. Siegert quickly recruited a corps of experienced pilots who were initially equipped with a variety of single engine reconnaissance planes capable of dropping small bombs. At sea, the navy would unleash its small submarine force to blockade British ports and strangle the economy. Hopefully Britain, which had much less at stake in the war than France or Russia, could be prevailed upon to abandon the Allied cause when placed under attack by sea and by air.

The German Army had no great love for the Zeppelin. However, in 1914–1915 it was the only aircraft available that could conceivably be used to attack Britain. In April 1911 General von Moltke had argued that the Prussian War Ministry should cut funding for Zeppelins in order to buy more airplanes. Army

manoeuvres had found that Zeppelin airships were highly vulnerable to ground fire due to their slow speed and lack of manoeuvrability.[4] Moreover, airships were very expensive, took a long time to build and needed massive hangars and special facilities to operate. On the other hand, airplanes were comparatively cheap and easy to build and repair and could be operated off of any flat field. Airplanes were less vulnerable to ground fire because they were smaller, faster and more manoeuvrable than airships. Airships were highly vulnerable to weather, any wind over 25 knots making them virtually unmanageable. Airplanes could be easily operated in moderate to heavy winds. Indeed, the only advantage that the airships had was their long range and their ability to carry a heavy bombload – often more than a ton of bombs. In short, airships, for all their drawbacks, were the only craft that could cross the Channel with a bombload. The navy, for their part, held a different view on Zeppelins. The navy appreciated the Zeppelins for their long range and endurance, which made them excellent craft for fleet scouting.

The Army's misgivings about the Zeppelin were confirmed by the disastrous performance of the Zeppelins in the first months of the war. At the start of the war the Army had four Zeppelins available in the West and three in the East. The Z-6 made a bombing raid on Lüttich on 6 August and dropped 200 kg of bombs. It was hit by ground fire and crash-landed and dismantled. The Z7 and Z8 bombed French troops in Alsace and were promptly hit by ground fire and disabled. The Z9 made successful bombing attacks on Antwerp, Ostend, Zeebrugge, Dunkirk, Calais and Lille dropping several thousand kgs of bombs. However, it was lost to a British raid on its shed in Duesseldorf on 8 October.[5] The British recognized the latent threat of Zeppelin raids on Britain and began an aggressive program of attacking any Zeppelin shed within range of its planes (carrying a few 20 lb bombs) in October–December 1914.[6]

The German navy was the first to push for Zeppelin raids against Britain. In a naval Staff memorandum of late 1914 the navy argued that raids on London would 'diminish the enemy's determination to prosecute the war'.[7] The Kaiser objected to the idea of bombing his cousins in Britain and concerned about the effect of world opinion in bombing undefended cities. However, the Navy and Army soon overrode the Kaiser's objections. Ironically, although he was virtually an absolute ruler as Emperor and 'Warlord', he turned the whole direction of strategy and the war effort over to the armed forces at the start of the war and served throughout the war as a presiding over innumerable parades and reviews. By late 1914 Germany the military was in charge of Germany and the Kaiser not much more than a figurehead who approved the policies (and chancellors and politicians) that the generals and admirals put before him.

THE ZEPPELIN RAIDS ON LONDON

In early 1915 the High Command had settled on the idea of bombing England. The army disliked the Zeppelins, but they were the only weapons available that could do the job. The navy, on the other hand, was positively enthusiastic about the Zeppelins. By December 1914 the navy had 3,740 men at 9 bases of the airship branch. While the navy awaited new, much larger Zeppelins they trained the force and tested a variety of bombs.[8] In the meantime, Siegert's 'Carrier pigeon Detachment' carried out its first bombing raid in January 1915 when a squadron of 2-seat bombers led by Siegert dropped 123 bombs on the port of Dunkirk.[9] By this time, the High Command was so taken with the idea of a strategic bombing force they directed the formation of another bomber wing to be under its direction at Metz.

The first bombing raids on England with army and navy Zeppelins were against the East Coast in January 1915. By Spring the military had overcome the Kaiser's objections to bombing London and on 31 May the Zeppelins attacked Britain's imperial capital for the first time. The first raids caused a

sensation and a serious panic in the city of London. More raids were made in the Summer of 1915 but by Fall the Zeppelin force found that they had to switch to night attacks and fly at much higher altitude in the face of increased British antiaircraft and fighter defences. Zeppelin losses were heavy and by October the army had lost hope in the campaign, although the navy would continue with a few attacks in the spring of 1916. The whole airship campaign of 1915–1916 had dropped a grand total of 155 tons of bombs and killed 500 and wounded 1,200 Britons. Given the loss of airships and crews, it was not considered to be an effective campaign.[10]

Although the Zeppelin raids were considered unsuccessful, the Germans developed several useful technologies to support the bombing campaign. Long distance aerial navigation was new to every air service and the Zeppelins, flying long distances from Germany and sometimes in the air for more than 12 hours, needed to be able to pinpoint their location and the target. The Germans found that they could 'fix' the location of their airships by sending radio transmissions and have receiving stations with known locations transmit the signal direction back to the airship. With two or more receiving stations providing signal directions to the airship, the Zeppelins were able to triangulate the headings and get accurate location. It was the first use of radio direction finding in aviation history.[11]

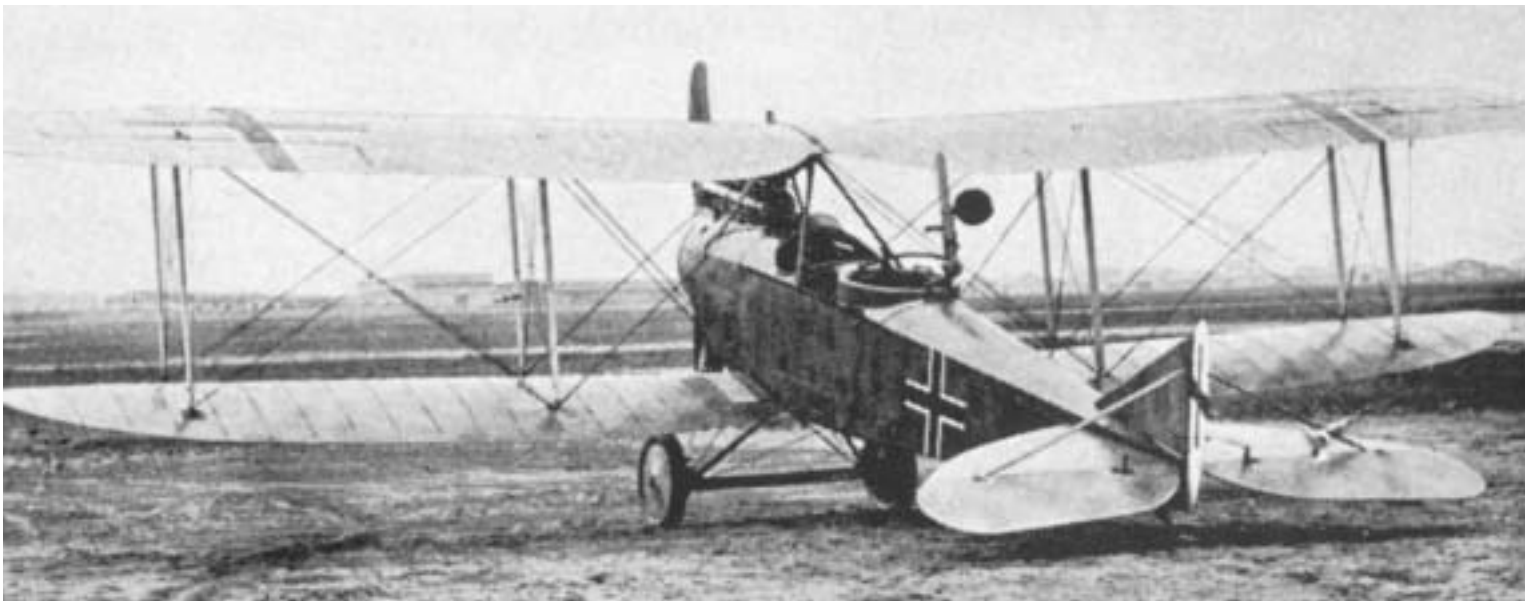
The Germans developed the most effective systems for night landings of all the powers. Sunken lamps acting as beacons were set into the middle of German landing fields

German AEG night bomber

TECHNOLOGY AND LONG RANGE BOMBING

The Germans recognised that Allied air defences would make the heavy bombers highly vulnerable to fighters and flak in daylight raids and that night-time raids would likely be necessary over the heavily defended Western Front in order to avoid the Allied air defences. This led to a whole new range of problems that required new technologies and weapons. As with navigation by means of radio signals, during the course of the war the Germans usually took the lead in developing new technologies for the bombers. One of the most difficult problems was night navigation by the heavy bombers. Germany had built the first aerial 'lighthouse' for night aerial navigation in 1913. As the war progressed, a lighthouse system was established in which the lighthouses would emit a unique signal of lights, usually in a Morse code sequence, which could be regularly changed for security reasons. In addition to lighthouses, various lights in the shape of crosses, triangles etc. were set up behind the front to help steer the bombers to their objectives. In good visibility such signals could be seen for 40 miles. Another ingenious night navigation method was the firing of parachute shells of different colours at altitudes of 6,000 feet. Such shells could be sequence or colour-coded and were visible from 50–100 km. No such system was available to the Allied air forces.[12]

One of the most difficult problems in night flying in World War I was landing at night. The Germans developed the most effective systems for night landings of all the powers. Sunken lamps acting as beacons were set into the middle of German landing fields. A series of red lamps radiating out from the central beacon gave the wind direction so that the pilot could land into the wind. Electric lamps were also used to illuminate the airfields.[13] None of the Allied powers had as sophisticated a system for providing wind direction.



With the Rumpler reconnaissance plane, the Germans could obtain good aerial photos of targets deep within France as the Allied fighter pilots flew at their maximum ceiling 3,000 feet below them

The first true bomber in production was the AEG K I, a two-engine biplane powered by 100 hp Mercedes engines

Numerous other problems had to be solved by the Germans to enable a long-range bomber campaign. The higher altitude of the later Zeppelin models of 1915 meant providing oxygen to the crews. The Germans quickly developed a system of oxygen bottles and a simple respirator to be used by airship, bomber and high altitude reconnaissance crews. The Germans also developed electrically-heated flight suits for extended operations in the extreme cold of the high altitudes. Then, as now, one of the most important requirements for a bomber force was accurate intelligence. The standard German two-seat reconnaissance planes were at great risk flying even a short distance over the front lines to take aerial photos. However, bombing targets deep behind the enemy lines would require long distance photo-reconnaissance missions in skies filled with enemy anti-aircraft and fighters. The German solution was to simply fly over the enemy opposition. In 1917 the Rumpler Company fielded a two-seat reconnaissance planes especially designed for high altitude. With a large wingspan for lift and a specially designed high compression in-line engine, the Rumpler C 7 could take its pilot and observer, both equipped with oxygen, up to 20,000 feet to photograph enemy targets with their excellent Zeiss cameras. No Allied fighter had the ceiling of the Rumpler and antiaircraft guns of the era could not shoot that high.[14] With the Rumpler reconnaissance plane, the Germans could obtain good aerial photos of targets deep within France as the Allied fighter pilots flew at their maximum ceiling 3,000 feet below them.

BUILDING THE BOMBER FORCE

Any discussion of strategic bombing was a mostly theoretical exercise until the technology appeared that could realise the dream. The concept of strategic bombing only became a reality because of the efforts of a few far-sighted German industrialists. In August 1914, Count Ferdinand Zeppelin, the famous airship builder, and aircraft designer Claudius Dornier began work on developing a large, multiengine aircraft that could be used as a bomber. At the same time, the aircraft division of Siemens corporation began development of a large aircraft. AEG, another major aircraft firm, was already working in a large 'battleplane' at the start of the war.[15]

The initiative to build large aircraft came from the aviation industry while the army, caught up in mobilising for war and the urgent need to build up the army's field reconnaissance units, expressed little interest at first in large aircraft development. However, in 1915 when the technological breakthroughs came, the Army Air Service quickly woke up to the possibilities. The Zeppelin-Dornier large aircraft prototype first flew in August 1915. The initial tests were successful and the army, now aware that long-range bombing was technically feasible, began ordering heavy bombers.[16] The first true bomber in production was the AEG K I, a two-engine biplane powered by 100 hp Mercedes engines. The next version, the AEG G II, soon followed and was powered by two 150-hp engines and able to carry a 200kg bomb load a considerable distance.[17]

The Gotha G IV bomber, which arrived to equip the 3rd Bomber Wing (Englandgeschwader) in early 1917 and became a standard bomber on the Western Front, was powered by two 260 hp engines and could carry a 1,100 lb bomb load

As soon as the AEG bombers rolled out of the factory they were deployed to the two bomber wings being organised on the Western Front. From 1915, when the first multi-engine bombers were employed, until the end of the war the size of the bombers, the engines, the range and their bomb-carrying capacity grew rapidly. By 1917 the Friedrichshafen G III (designed by Zeppelin and Dornier) could carry 3,000 lbs. of bombs and had a 5-hour endurance. The Gotha G IV bombers, which arrived to equip the 3rd Bomber Wing (Englandgeschwader) in early 1917 and became a standard bomber on the Western Front, was powered by two 260 hp engines and could carry a 1,100 lb. bomb load.[18]

In April 1915 German army aviation was reorganised. The post of 'Chief of Field Aviation' was created and the experienced airmen Col. Hermann von der Lieth-Thomsen appointed with Wilhelm Siegert as his deputy. The Aviation Inspectorate of the army and control of German aircraft production and development was placed in the hands of Thomsen and Siegert.

As chief of field aviation, Lieth-Thomsen was a strong advocate for bomber development and production. In a memo of August 1916 he argued that the aviation industry needed to speed the development of large 4-engine heavy bombers. He made plans to increase the bomber force of the Luftstreitkräfte to 108 bombers by the Spring of 1917.[19] 1916 became the testing year for the Air Service's new bombers. Small bomber units were deployed to various fronts and tried out in combat. By April 1916 5 bomber wings had been organised, along with two flights (Detachments Rfa 500 and 501) of the huge 4-engine 'Riesen' (Giant) bombers, which were send to the Eastern Front for combat testing in a fairly safe environment.[20]

There was a strong demand for heavy bombers throughout the army. On the Eastern Front and in the Balkans, the bombers were found especially useful for interdiction missions. The more primitive

transportation net in Eastern and Southern Europe offered the Germans the possibility of easily blocking enemy transport. Russia and Romania had far fewer roads and rail lines than the Western Allies and, consequently, each railyard and depot was far more important for the enemy armies. Damage or disruption to the more fragile logistics system of the Russians or the Balkan nations fighting with the Allies would have a pronounced effect, especially as the Russians were already strained past the breaking point in supporting and supplying her army in the field.

The Luftstreitkräfte was again reorganised in late 1916 and given a higher status within the German Army with its own general staff and a very capable senior officer, Lt. Gen. Hoeppner

The Luftstreitkräfte was again reorganised in late 1916 and given a higher status within the German Army with its own general staff and a very capable senior officer, Lt. Gen. Hoeppner, as director of all army aviation and full control of the German aircraft industry. The Luftstreitkräfte tried to increase the bomber force as quickly as possible but was limited by production problems in the aircraft industry as well as a serious shortage of trained pilots and officers for the bomber units. Bombers were far more complicated to fly, navigate, maintain and support than a fighter or observation unit and needed more specialist ground crews. By this point in the war, the shortage of trained personnel became as much of a limitation of the bomber force as aircraft.[21] However, by early 1917 the Air Service had built up a force of over 100 heavy bombers ready to be used on the Western Front.

REVISED BOMBER DOCTRINE 1917

By the Spring of 1917 the Luftstreitkräfte organisation and doctrine had reached a high degree of maturity. By early 1917 most of the Luftstreitkräfte consisted of fighter and bomber units, as contrasted with the mostly reconnaissance and observation force of 1915 – 16. The summer of 1917 witnessed some major organisational changes. Squadrons and flights were combined into larger wing organisations, a step that represented the much larger scale of

aerial warfare. In June 1917 four of the top fighter squadrons were assembled to form Jagdgeschwader1 under the command of Captain Manfred von Richthofen. This force could fly and fight as a single force of 70 aircraft.

By the Spring of 1917 one can speak of true operational-level air campaigns The aviation commander of a German field army might have several hundred aircraft under his command. For example, to oppose the British offensive in Flanders in the Summer and Fall of 1917 the Germans massed over 700 aircraft of all types along with a large flak force in support of the German 4th Army and under command of its aviation commander, Captain Helmuth Wilberg.

To provide some operational doctrine for this new level of complexity in aerial warfare the Luftstreitkräfte commander, General von Hoeppner, issued a manual of considerable length and detail in May 1917. 'Directives on the Mission and Utilization of Flying Units Within an Army'. (Kommandierende General der Luftstreitkräfte. *Weisungen für die Einsatz und die Verwendung von Fliegerverbänden innerhalb einer Armee*) The Directives outlined doctrine for all of the major missions of the Luftstreitkräfte units and the bombers were covered at some length.

The squadrons of heavy bombers (usually two or more engine aircraft) were referred to as the 'High Command's Bomber Squadrons', reflecting the fact that heavy bombers were carefully allocated under the direction of the High Command. The Luftstreitkräfte envisioned the heavy bombers as essentially multipurpose weapons. 'The High Command's bomber squadrons are primarily equipped ... against targets of every type. Their heavy armament enables them to carry out strafing attacks upon ground targets as well. They are capable of reconnaissance flights in addition to their other missions'.[22] Concerning the heaviest bombers, the *Riesenflugzeuge*, the *Directives* noted 'By virtue of their large

Bombing attacks require careful preparation by aerial photography, careful disposition and heavy, repeated attacks against the same target, with little time in between

Captain Ernst Brandenburg

carrying capacity and their powerful armament, heavy bomber aircraft are most suitable for attacks against targets capable of resistance and located deep in enemy territory. Their employment depends upon the amount of enemy anti-aircraft weapons. Employment under the cover of darkness is preferred'.[23] For daytime operations the norm for the light and heavy bombers was to operate in squadron or group strength and support form escort fighters was advised.[24]

A doctrine of air superiority was laid out. The *Directives* stated that 'A purely defensive campaign does not achieve the goal'.[25] Fighters would be massed and defeat the enemy fighter forces—and open the way for the free operation of the reconnaissance and bomber forces.[26]

The *Directives* contained several paragraphs on the conduct of bombing attacks: 'Bombing attacks require careful preparation by aerial photography, careful disposition and heavy, repeated attacks against the same target, with little time in between'.[27] 'Dispersion of forces by simultaneous attacks against numerous targets must be avoided. Attacks will succeed by narrowing the targets to a few especially important targets. Primary targets are field depots, rear area rail switchyards, headquarters, communications centres, ammunition dumps and, most importantly, industrial facilities producing war material. The greatest effect can be brought about in theatres where air defence is still minimal.'[28]

The *Directives* give responsibility for target selection and the timing of attacks to the Field Army commander and his aviation commander. The aviation commander was responsible for mission orders and planning and the effect of a mass attack was preferred.[29] The strength of the enemy air defence would be the determining factor in choosing whether the bombers would strike by night. 'Defence by enemy aircraft is thereby ruled out and the effectiveness of flak is decreased. The lower flying altitude which is possible increases accuracy and allows for a heavier bomb load.'[30]

THE SECOND BOMBING CAMPAIGN AGAINST LONDON

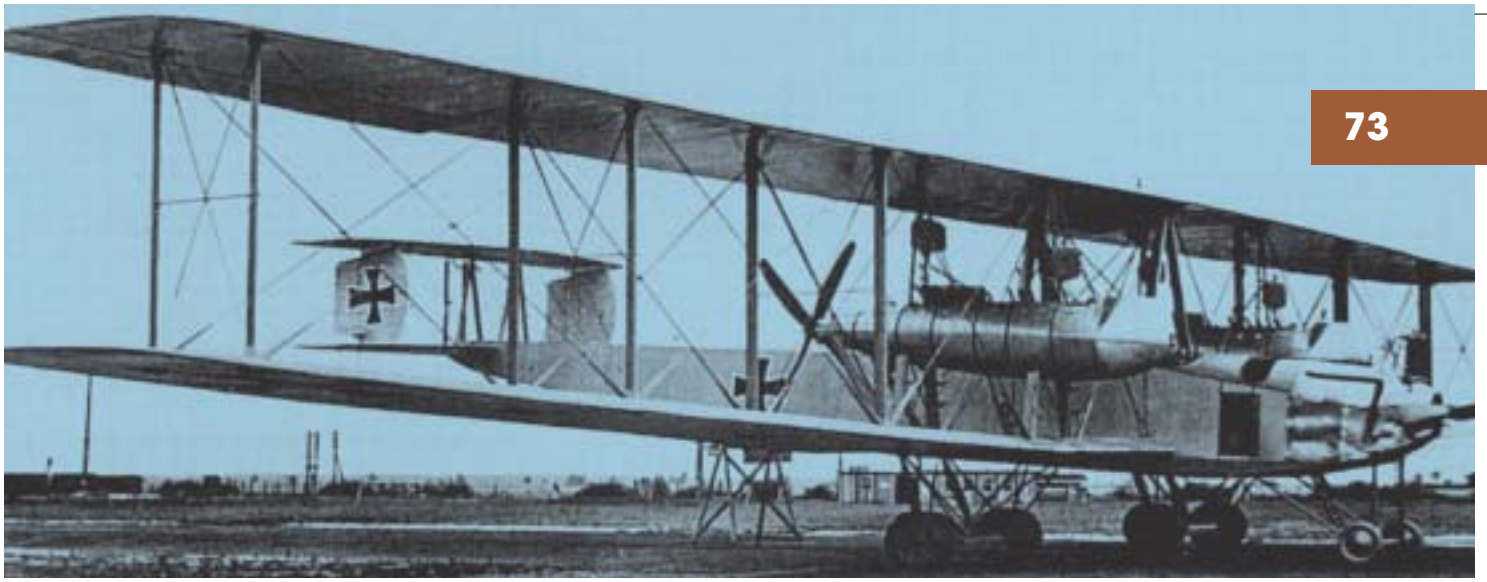
Captain Ernst Brandenburg prepared his reinforced bomber wing (considerably larger than other German bomber wings), the *Englandgeschwader*, through the Spring of 1917. By late May he had more than 40 Gotha G IV bombers, large biplanes with an 80-foot wingspan, two 260-hp engines and a 3-man crew, ready for the campaign against London. The Gotha had a relatively high ceiling and a 1,100 lb bomb load. However, the over 100 miles to London from the German bomber bases in Flanders was at the extreme range for the lumbering biplanes (maximum speed only 88 mph) which would normally carry a much smaller bomb load.[31] In planning the campaign, Brandenburg had to create a whole system of tactics for the conduct of long distance bombing raids against cities virtually from scratch. Nothing like this had ever been done before. Brandenburg had to create targeting guidelines, plan operations, create formations for massed flight, determine the optimum bomb loads and best fusing for the bombs and decide upon the best attack altitude. Because these would be long-range missions, weather information became central to planning. Long distance bombing raids are an extremely difficult process even today, and Brandenburg deserves a great deal of credit for being the first to make it happen.

Eighteen Gothas bombed London from 8,000 feet and killed 162 and wounded 432 Londoners. No British planes opposed the Gothas as they bombed the city in a leisurely fashion and departed without losses

Brandenburg led his bomber wing on the first raid against London on 13 June 1917. Eighteen Gothas bombed London from 8,000 feet and killed 162 and wounded 432 Londoners.[32] No British planes opposed the Gothas as they bombed the city in a leisurely fashion and departed without losses. As with the 1915 bombings there were panics and demonstrations. This time it was worse and the British Cabinet met and made several emergency decisions to improve air defences against German raids. British fighters were pulled out of action on the Western Front and brought back to defend London. The London anti-aircraft defences were dramatically increased.[33] The Germans continued with daylight raids for the next weeks when conditions were favourable but the increased British defences concerned the Germans and Brandenburg stopped the daylight raids in August as too dangerous. After a brief period of retraining, the Englandgeschwader resumed bombing London at night. Later raids would feature bombing by the four-engine Riesenflugzuege such as the Siemens-Schuckert, which carried a far larger bomb load than the Gothas. By 1918 R-planes were using 660 lb. bombs.[34] However, the same level of panic among the Londoners did not occur in the later raids. As would be noted in World War II, people can even get used to aerial bombardment.

The Englandgeschwader continued with its raids on England in a desultory fashion until May 1918 when the campaign was called off. In that month Brandenburg lost 6 of his 43 Gothas.[35] The Luftstreitkräfte determined that the strategic bombing campaign against London was simply not worth the price. For the German bomber force, it was an expensive campaign indeed. From June 1917 – May 1918 the Englandgeschwader lost 62 bombers in 27 raids.[36] It was not the British defence measures that drove off the German bombers. Only nineteen of the German heavy bomber losses can be attributed to British antiaircraft fire or fighter planes. The other 43 German bombers were all lost due to operational accidents. Of the forty-three operational losses, 37 aircraft were lost to landing accidents. One of the technological problems that had NOT been solved by the Germans (nor by the Allies) was an effective landing gear for the heavy aircraft. These machines were underpowered, awkward to fly and difficult to land. Landing in a modern controlled airport at night is difficult enough for the average pilot. Trying to land a very heavy, underpowered airplane on a soggy field at night in the lighting conditions of a 1917 airfield took more skill than the average pilot would have.

The entire German bombing campaign against London in 1917 – 1918 cost the English 836 dead and 1982 wounded. A very small loss of life by World War II standards, but shocking at the time.[37] Although



By 1918 R-planes were using 660 lb. bombs. However, the same level of panic among the Londoners did not occur in the later raids. As would be noted in World War II, people can even get used to aerial bombardment

the first attempt to use the bomber in a decisive fashion to break the will of the enemy civilian population had failed, the German High Command still viewed the bomber as an extremely important weapon.

OTHER BOMBING CAMPAIGNS

London and Flanders were not the only theatres of operations for the German heavy bombers in 1917. Starting in the Spring of 1917 German bombers based in Metz began a series of long-range attacks against the centres of the French armaments industry. The industries around Nancy provided the best strategic targets within range of the German bombers. The first air attacks on Nancy, made before the attacks on London, were viewed by the Germans as a dress rehearsal for London raids. The German raids were considered successful and proved the capabilities of the heavy bombers as they could navigate a long distance and hit the target with some accuracy. New munitions were tried in the French attacks and the German bombers usually carried 90-kg bombs. Although the Germans overestimated the damage inflicted upon the French factories, simply finding and hitting the targets demonstrated great potential. By July 1917 the attacks on French industries reached a crescendo with eleven attacks upon the Nancy region that month. After that, German bombers were generally diverted to attacking French rail lines in an attempt to disrupt the Allied offensive in Flanders.[38]

GERMAN INTERDICTION CAMPAIGN — 1917

While Brandenburg's Englandgeschwader was preparing to bomb London in early 1917, other German bomber wings were being readied for service on the Western Front. The Flanders Front was seen as the most dangerous sector for the German army in the Spring and summer of 1917. Two heavy bomber wings were transferred to the German 4th Army in Flanders to carry out a strategic interdiction campaign to disrupt the logistics for the British offensive.

When the massive British offensive in Flanders began the Germans reinforced their front and built up a force of over 700 aircraft. Captain Helmuth Wilberg, 4th Army aviation commander, used his two heavy bomber wings to conduct a series of raids against the British and French airfields and air depots as part

of an air superiority campaign. Wilberg's bombers attacked the Allies at night and dropped parachute flares to illuminate their targets. The German raids on the Allied airfields turned out to be surprisingly successful. One German bomber raid on the night of 6/7 July 1917 against the British airfield at Bray Dunes damaged 12 aircraft.[39]

The German bombers attacked the British airfield and depot at St. Pol on 24 September and heavily damaged the base. One bomb hit on a hangar destroyed 140 stored aircraft engines.[40] On the night of – October the German bombers returned again to St. Pol and destroyed 36 British and French aircraft as well as severely damaging the hangars and the depot.[41] Just a few raids destroyed a large number of Allied aircraft on the ground and caused heavy damage with little loss to the Germans. This was a cost/benefits ratio that the German High Command preferred to the results of the London attacks.

During the height of the Flanders battle the Germans made numerous bombing raids against the French rail yards supporting the BEF's offensive and against the BEF's most important port facilities in Northern France, especially the ports of Calais and Dunkirk. The German intent was to seriously disrupt the British logistics system and a series of almost nightly raids began in June and July 1917. [42] In A ugust the British ammunition dumps at Dunkirk sustained severe damage. After one especially devastating raid on Dunkirk on 3 October it took four days to put out the fires.[43] The German bombing raids behind the British front lines did not succeed in disrupting the British logistics flow, but they certainly were a serious inconvenience and they caused the British considerable concern.

Just as fighter aces had become popular heroes in the Fatherland, bomber 'aces' were also honoured with the Pour le Merìte and were celebrated in the popular journals and on cigarette cards. Captain Alfred Keller, Commander of the 1st Bomber Wing and a specialist in night bombing was awarded the Pour le Merìte by the Kaiser after his wing dropped 100,000 kgs of bombs on Dunkirk. A total of 300,000 kgs of bombs were dropped by the German heavy bomber force against BEF rear areas during the 1917 Flanders campaign.[44]

Although the heavy bombers were normally used for strikes deep behind the lines, on a few occasions the heavy bombers were used for close support right on the front lines. During one of the most desperate phases of the British offensive, 1st bomber wing Gothas, accompanied by 2-seater attack planes, carried out a one hour attack directly behind the British front lines in order to get the 'maximum moral effect on the first line of the British reserves'.[45] However, it should be noted that such use of bombers for close support was a rare exception and only carried out due to a crisis at the front.

THE 1918 CAMPAIGN

The German high Command had placed a high priority on bomber production when formulating their aircraft production plans in 1917 (the Amerika Plan). The goal was to produce 2,000 aircraft a month in 1918—a goal the Germans did not come close to meeting although the German production did increase to well over 1,000 planes a month. However, the Germans managed to slowly build up their bomber force despite high attrition. By the time of the March 1918 German offensive in the West, the Luftstreitkräfte had 7 bomber wings available, each wing with 4 – 6 squadrons. Although the raids against London were still proceeding, four bomber wings, more than half of the German bomber force, was concentrated for the support of the three German armies that attacked in march 1918.[46]

The mission of the bombers was first to conduct night attacks on Allied headquarters and airfields.[47] As the German offensive progressed the bombers switched their targets to the railyards throughout northern France with the intention of disrupting allied attempts to reinforce and resupply their threatened

sectors.[48] Throughout 1918 the High Command continued to try to build up the strength of the heavy bomber force despite the heavy attrition in all branches of the Air Service. In early 1918 an eighth wing was added to the Air Service and in the Summer of 1918 a ninth wing was organised, mostly by reducing the size of the Englandgeschwader.[49]

After the failure of the campaign to bomb London into submission, the German High Command had not lost faith in the use of strategic bombing to damage Allied morale. After the bombing campaign against London had been called off the Germans turned to attacking Paris with heavy bombers. The Germans bombed Paris on numerous occasions in 1918 with the loss of 308 French civilians killed and 539 wounded. As in England, the French built up a formidable air defence system around Paris and German losses forced the end to the attacks.[50] Interestingly, the French population proved to be better able to take punishment than the English and there were no outbreaks of panic in Paris as had occurred in London in 1915 and 1918.

The development of the technology of strategic bombing continued rapidly up to the end of the war. One of the most important developments of World War I was in bomb design and effectiveness. Starting with small bombs made from modified artillery shells, by 1918 the Germans were able to employ large, purpose-built bombs of up to 1,000 lbs. designed for better ballistic characteristics and accuracy. In 1918 the Germans developed a small (2 kg) magnesium-based incendiary bomb. Many of these could be loaded into a canister that, when dropped, would open and spread the small firebombs over a broad area. This was the father of the Luftwaffe's incendiary bombs that would be used with devastating effect upon the British cities during the Blitz of 1940 – 41. If the Allied bomber force had used gas on German cities in the 1919 campaign, the German High Command planned to retaliate with incendiary attacks upon London and Paris. Luckily for both sides, this plan for strategic bombing would have caused far greater casualties and damage than the small number of high explosive bombs dropped in the 1917–1918 campaigns.

CONCLUSION

When looked at in modern terms, or even in the framework of World War II, the strategic bombing campaigns of World War I did not really amount to much. Despite the great effort that went into the program, the German bombers were too few and the bombloads of the era were simply too small to inflict crippling damage upon the enemy. However, in terms of the development of a major new weapon and an effective doctrine for its employment, the German Air Service's accomplishments are impressive indeed. In only two years the German Air Service went from prototype heavy aircraft, to the employment of large bomber units in a coherent and well-planned strategic campaign against England and targets on the Western Front. By 1917 a fairly sophisticated operational doctrine had been worked out as well as the tactics for conducting bomber attacks by day and night.

Although disappointed by the failure of the bombing attacks upon London or Paris to break the enemy will, the Germans were impressed by the performance of the bombers against transportation targets. The ability of the Germans to bomb the French industries around Nancy was also remembered. At the end of the war, the High Command and general staff was convinced that the heavy bomber had a major role in any future war.

Although Germany was basically disarmed after World War I, the army maintained a secret air staff hidden within the general staff and developed a secret air force to train personnel and to develop and test airplanes and bombs. Convinced that rearmament would someday come, the general staff and secret air staff developed an extensive body of doctrine for a future air war in the 1920s. The wartime

experience of strategic bombing heavily coloured all the German views on air doctrine in the 1920s and 1930s. One of the most notable examples of this was the German preference for interdiction campaigns against rail, port and logistics targets deep behind the enemy lines. General von Hoeppner, commander of the Luftstreitkräfte from 1916 – 1918, argued that the interdiction campaign against the British in Flanders in 1917 had caused some serious damage to the enemy. He also believed that the attacks against the Allied rail centres in 1918 had been fairly successful.[51] This was the mainstream view among the airmen and strategic interdiction was the subject of several studies by experienced German airmen commissioned by the Army staff in 1920 – 21.

The new German Army doctrine, published between 1921 and 1925, emphasised the role of heavy bombers in war, especially in attacking enemy railyards and supply depots in night attacks.[52] This emphasis on using bombers for the interdiction of enemy logistics and transport deep behind enemy lines was characteristic of German air doctrine throughout the interwar period and into World War II.

The use of bombers to attack the enemy cities and industries, as at Nancy in 1917 and against London and Paris was also carefully studied by German airmen after World War I with the intent of drawing tactical and operational doctrine from the experience. The secret air staff, under the direction of LTC Helmuth Wilberg (who had commanded almost half of the German bomber force in 1917), carried out a series of wargames to develop plans and doctrine. The first major air staff wargame was in 1924 and the scenario postulated a French attack against Germany. The Germans drew up a strategy based on attacking the French air force by crippling the aircraft industry. A list of the eight most vital aircraft and motor factories in France was developed as a target plan for a strategic bomber force. If those eight factories could be taken out, then the French Air Force would be unable to replace its losses.[53]

By 1926, the German air staff had secretly published an extensive doctrine for strategic air war (Directives for the Execution of the Operational Air War, May 1926). In the 1926 doctrine, the Germans understood that the heavy bomber would be the core of its air force when rearmament came. The 1926 doctrine discussed in detail a doctrine for bombers attacking 'the sources of enemy power' to include enemy cities, ports, railyards and vital industries.[54] The 1926 air doctrine gave a fairly equal weight to bombing enemy industrial centres and cities and attacking interdiction targets such as enemy transportation centres.

The German army and its secret air staff in the 1920s used the experience of German strategic bombing in World War I to draw up a pragmatic and comprehensive doctrine for aerial warfare. The study of the German strategic bombing in World War I became the foundation of much of the German air war doctrine at the start of World War II. The German general staff and the airmen took great pride in what the heavy bomber force had accomplished in short time and limited resources in 1915 – 1918. Despite all of the technological hurdles and limitations of the era, the German strategic bombing program had been moderately effective. Just as impressive was the creation of effective bomber doctrine and tactics in 1917. After World War I, as new aviation technologies developed with astounding speed, German airmen drew lessons from the experience of the war and looked to the time when the promise of strategic bombing glimpsed in World War I might be fulfilled.

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