

# British Journal for Military History

Volume 5, Issue 2, October 2019

---

Three-dimensional Warfare – The Invention of Aerial Combat

**Simon J House**

---

**ISSN:** 2057-0422

**Date of Publication:** 24 October 2019

**Citation:** Simon J House, 'Three-dimensional Warfare – The Invention of Aerial Combat', *British Journal for Military History*, 5.2 (2019), pp. 40-57.

[www.bjmh.org.uk](http://www.bjmh.org.uk)

---



This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.



The BJMH is produced with the support of **Goldsmiths**  
UNIVERSITY OF LONDON

# Three-dimensional Warfare – The Invention of Aerial Combat

SIMON J HOUSE\*

Independent Scholar, UK

Email: [simon.house1@btopenworld.com](mailto:simon.house1@btopenworld.com)

## ABSTRACT

*On 24 September 1910 the British Flight magazine published as its lead article ('The New Arm') a piece on the recent Grand Autumn Manoeuvre of the French Army in Picardy. For the first time in history, military aircraft had been deployed on both sides in a reconnaissance and artillery spotting role. The article stated that 'the aeroplane, even in its present stage of development, has already resulted in an urgent need for the entire revision of all accepted schemes of tactics in warfare.'*<sup>1</sup>

## Introduction

The purpose of this article is threefold: firstly to remind readers of the startlingly rapid development of early air power prior to the start of the First World War. From the first 59-second powered flight on 17 December 1903 to the establishment of the world's first military air force (the French *Aéronautique Militaire*) on 22 October 1910, a mere six years and ten months had elapsed; during which technological development was matched by tactical innovation to a point that a whole new arm of the military had (literally) added a third dimension to warfare. The second point, briefly, is to remind readers of Anglo-Saxon military history that the first 100 days of the Great War witnessed a war of movement on the largest scale hitherto seen; furthermore it was a period dominated by immense clashes between large French and German armies, both using aeroplanes as their third arm. The very small British Expeditionary Force arrived three weeks after the start of the war; by which time three major Franco-German engagements had already been fought – in Alsace, Lorraine and the Ardennes – and the innovative tactical use of aeroplanes on

---

\*Simon House is an Independent Scholar who completed a Ph.D at Kings College, London.

DOI: 10.25602/GOLD.bjmh.v5i2.1312

<sup>1</sup><https://www.flightglobal.com/pdfarchive/view/1910/1910%20-%200768.html>, a digital copy of Flight Magazine, accessed 4 April 2018.

## THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

the battlefield had already started its development. Finally, it will reveal how the French squandered a significant military advantage following their early dominance of the development of aviation generally, and allowed the Germans to field a larger and more useful air force in August 1914.

This paper examines the birth and early development of aerial warfare, starting with the first powered flight in December 1903 and ending on 1 April 1915, the day that French pilot Roland Garros became the first man to shoot down an enemy plane using a machine gun firing through the propeller of his aircraft; the moment at which most histories of aerial warfare start. The choice of this period is driven by the argument that it was the true and most radical period of innovation, after which the issue became one of developing bigger and more powerful engines capable of driving aeroplanes that were more powerfully armed and better protected – at least until the development of airborne radar. For convenience the period under discussion will be examined in three chronological sections. During the first, from December 1903 to July 1909 when Blériot crossed the Channel, the military was only marginally engaged; flying was the preserve of pioneering aviators (some of whom were incidentally army officers) determined to sustain powered flight for ever longer periods of time. The second stage encompasses the period from July 1909 to July 1914, during which aviation was developed as a weapon of war and preparations were made for the use of primitive aircraft above the battlefield. The third stage, from August 1914 to July 1915, will examine the use of air power in the very early stages of the war, comparing differences between the French and German armies on the Western Front.

### Early Days, 1903–1909

The Wright Brothers' aeroplane, *The Flyer*, flew what is generally recognised as the world's first powered and manned heavier-than-air flight on 17 December 1903. It achieved a distance of 852 feet in 59 seconds on its fourth and last flight of the day.<sup>2</sup> Barely five-and-a-half years later, on 25 July 1909, Louis Blériot flew 23 miles to cross the Channel in 37 minutes, winning the English Lord Northcliffe's £1,000 prize and immortality in the history of aviation.<sup>3</sup> The period between the Wright brothers' pioneering flight in 1903 and Blériot's cross-channel flight in 1909 was dominated by one simple technological issue in which the emphasis was simply on getting an aeroplane to sustain flight. The key to success was the power-weight ratio of the aircraft and therefore the power and weight of the propulsion system. Here the French achieved an immediate and sustained advantage through their pioneering

---

<sup>2</sup>J. E. Walsh, *First Flight: The Untold Story of the Wright Brothers* (London: George Allen, 1975) p. 144.

<sup>3</sup>W. Raleigh, *The War in the Air, Volume I* (Oxford: Oxford University Press, 1922) p. 106.

research and development of the aero-engine. Furthermore the French Ministry of War was secretly funding this research.<sup>4</sup> Indeed, even before the beginning of the age of powered flight, France had been the leading proponent of military research into aviation. According to John Morrow, 'The French army had been interested in heavier-than-air flight before it was practical.'<sup>5</sup> From 1892 to 1894 the French War Ministry subsidized Clement Ader with 550,000 Francs to develop a steerable flying machine capable of carrying passengers or explosives at a speed of 55kmh at an altitude of several hundred metres – 'a performance which was some 15 years in advance of aviation technology.' But they stopped in 1898, defeated, according to Morrow, 'by the absence of a light, powerful, and reliable engine.' Ader's first experimental plane was called *avion*, and years later he was honoured when the name was adopted into the French language as the general term for 'aircraft'.

In 1902, even before the Wright Brothers' flight, French engineer Leon Levasseur started work on developing a lightweight aero-engine that, he claimed, would 'conquer the air'.<sup>6</sup> Levasseur had calculated that a maximum ratio of about one kilogram (kg) per unit of horse-power (hp) was required, and indeed his first production model weighed 1.25kg per hp. This was the 'light, powerful, and reliable engine' that Clement Ader had lacked and that now enabled sustained powered flight; soon demonstrating that the aeroplane was on the verge of becoming a practical revolutionary weapon of war. By 1903 Capitain Christman, of the French government's Puteaux armaments factory, had become interested in Levasseur's research and development and, recognizing the military potential of the project, wrote to advise the War Ministry. This led to a meeting in 1904 between Minister of War General Louis André and Levasseur and his business partner Jules Gastambide; the outcome being the recommencement of secret military funding in order to support the project. Within twelve months, Levasseur had produced his V8 24 horsepower (hp) and soon afterwards 50hp *Antoinette* engine, fitting it to an airframe of his own design. By 1906 the Voisin Brothers were building an aeroplane around the *Antoinette* engine, which first flew on 13 January 1908, piloted by Henri Farman.

The breakthrough in military aviation came on 30 October 1908 when Farman's *Voisin* made the world's first cross-country flight (as opposed to circuits of an airfield), flying 30km from Bouy to Reims.<sup>7</sup> Not only did this show civilian flyers that

---

<sup>4</sup>C. Carlier, *Sera maître du monde, qui sera maître de l'air: la création de l'aviation militaire française* (Paris: Economica, 2004) p. 39.

<sup>5</sup>J. H. Morrow Jr., *The Great War in the Air* (Washington DC: Smithsonian Institution Press, 1993) pp. 7-8.

<sup>6</sup>Carlier, *Sera maître du monde*, p. 6 & pp. 38-41.

<sup>7</sup>Morrow, *The Great War in the Air*, pp. 7-8.

## THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

the 23 mile Channel crossing was at last viable, but it also demonstrated to the military that practical reconnaissance missions could be undertaken, and that aircraft were now ready to perform a valuable military role. Further proof of French dominance of aerial innovation lies in the fact that Britain's first military aircraft, the British Army Aeroplane No 1, failed to fly until an *Antoinette* engine was purchased to power it.<sup>8</sup>

The French can claim the credit for the breakthrough into sustainable long-distance flight afforded by the *Antoinette* aero-engine; but even as that power plant was gaining its reputation, its successor was in development. In 1906, Louis Seguin formed the *Société des moteurs Gnôme*, which two years later in 1908 produced the world's first production rotary engine. With its outstanding power-to-weight ratio of 1 hp per kg, the *Gnôme* rotary engine was a world-beating piece of engineering.<sup>9</sup> This was the power unit with which, in various upgrades, France went to war and which sustained the allied air forces for the early years of air fighting and beyond.

Meanwhile German development of military aviation had initially gone down a different path. On 2 July 1900, Graf Ferdinand von Zeppelin launched his first airship, LZ1, on its maiden flight over Lake Constance in southern Germany. The flight lasted eighteen minutes and covered five-and-a-half kilometres. Progress was swift: in 1907 Zeppelin LZ3 flew 350km in under eight hours. By 1907–1908, flights of eight to twelve hours, covering ever longer distances, were being regularly achieved with a reliable and technologically proven product, and the German War Ministry and General Staff committed itself to these dirigibles for long range strategic reconnaissance; a commitment that was manifested by government funding and sponsorship and culminated in early 1909 with Zeppelin LZ3 being bought by the War Minister and rechristened 'army airship Z1'.<sup>10</sup> Despite this high-level focus on dirigibles rather than aeroplanes, a certain Captain Hermann von der Leith-Thomsen of the German General Staff – later to be Germany's 'Chief of Field Air Forces' in 1915 – tried in early 1907 to kick-start a military aviation programme, but his chosen option – to buy aeroplanes from the Wright Brothers – was rejected because of their price.<sup>11</sup> Although by the autumn of 1908 there were ten small German private enterprises experimenting with and building aeroplanes, there was no official backing from the military for a focused programme.<sup>12</sup> The German War Ministry had taken a

---

<sup>8</sup>[www.gracesguide.co.uk](http://www.gracesguide.co.uk), accessed 16 August 2019

<sup>9</sup>J. Murphy, *Military Aircraft, Origins to 1918* (Santa Barbara, Ca: ABC-Clio, 2005) p. 32; Morrow, *The Great War in the Air*, pp. 12-13.

<sup>10</sup>Morrow, *The Great War in the Air*, p. 3.

<sup>11</sup>Morrow notes on p. 6 that France similarly declined the Wright Brothers' expensive offering, and decided to build her own.

<sup>12</sup>*Ibid.*, p. 8.

conscious decision not to sponsor the development of a heavier-than-air craft, preferring to wait until private industry had produced an acceptable aeroplane.

Much of the early German design and production was based on – sometimes copied from – the French. In August 1908, August Euler, an Austrian living in Germany, founded Germany's first aircraft factory in Darmstadt and started building French *Voisin* aeroplanes under licence, before developing his own designs. LVG (*Luft-Verkehrs-Gesellschaft*) built Farman-type aeroplanes before branching out on its own designs. Against the trend, an innovative design (an elegant monoplane called the 'Dove' (*Taube*) built in 1909), by Igo Etrich, another young Austrian working in Germany, was based on the pioneering work on gliders by Otto Lillienthal. Edmund Rumpler opened his factory in Berlin in November 1908 and copied Etrich's *Taube*. An engineer called Ernst Heinkel was chief designer for Etrich before moving on to Albatros and (after the war) setting up on his own. Hugo Junkers, aged fifty in 1909, in that year joined with Hans Reissner (the designer of the first all-metal airframe) to build successive experimental aircraft, culminating in the J1 all-metal, 2-seat, armoured aircraft of 1915. The purpose of this roll-call of early German pioneering aviators is to show that, when the time came for the German War Ministry to jump aboard the heavier-than-air craft bandwagon, there was sufficient progress within the home-based civilian aviation industry for the military to buy in quickly to a competitive position in the race to build an air force.

### **Genesis of Military Aviation, August 1909–July 1914**

On 22 August 1909, barely a month after Blériot's flight, the world's first air show was held - in France. At the Reims Air Meeting the first international gathering of aviation pioneers competed for various prizes and showed off their innovations.<sup>13</sup> Of course, there was a significant military presence; the Meeting had attracted the attention of both Colonel Estienne of the Artillery Directorate at the Ministry of War and of General Pierre Roques, Director of Engineering. Both saw immediately that the military potential of the aeroplane could at last be exploited. It was the beginning of an internal power struggle between the artillery arm and the engineers; harbinger of the bureaucratic rivalry that would ultimately cause France to lose its early dominance in the race towards effective use of aeroplanes over the battlefield. General Roques, a friend and former colleague of General Joffre (commander-in-chief designate from January 1911), moved first and fastest. He started to purchase aeroplanes and arranged for aeronautics to be the technical theme of the 1910 Grand Autumn Manoeuvre in Picardy. There he provided an *escadrille* of four

---

<sup>13</sup>Carlier, *Sera maître du monde*, pp. 132-134.

### THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

aeroplanes for each side, as well as two others for the umpires.<sup>14</sup> The aircraft were a great success, attracting the attention of all the Great Powers and catalysing programmes aimed at catching up with the French. But General Roques was determined to drive the French military aviation programme forward and maintain France's early lead. As early as 22 October 1910 - immediately after the conclusion of the manoeuvres - he had decided to pin his career and future prospects on air power, setting up an Inspectorate of Military Aviation within the Engineering Directorate, with himself as Inspector. Over the next two years he used his political skills to fight off the challenge from the Artillery Directorate for ownership of the use of aeroplanes, whilst at the same time manoeuvring within the War Ministry to split aviation from the Engineering Directorate and to set up a new Military Aviation Directorate with himself at its head – an objective that he met in the autumn of 1912.<sup>15</sup> As a result of the progress made in 1910–12, the French army forged ahead in its use of air power, gaining a significant advantage over both Germany and Britain.

In October 1911 Lieutenant Ralph Glyn, an officer attached to the newly-formed British military Air Battalion submitted 'a very full and illuminative report' on the state of continental military air power to the British Government.<sup>16</sup> In it he recorded that the French War Ministry:

had at its disposal, so far as could be ascertained, something between two hundred and two hundred and twenty aeroplanes. The biplanes were all Farmans. The monoplanes, which were on the whole preferred by expert opinion to the biplanes, were of many types, all famous for their achievement – Nieuports, Blériots, Deperdussins, R.E.Ps, Antoinettes, and others. The methods of training were elaborate and complete, and the air corps was continually practiced in co-operation with all other arms – infantry, cavalry, and artillery.<sup>17</sup>

He went on to comment particularly upon 'French aeronautical exercises carried out by the French air corps at the Camp de Châlons during the previous August' adding that 'the Germans have suddenly realized that the French Army, since the general employment of aeroplanes with troops, has improved its fighting efficiency by at least twenty per cent'. Of the state of German military air power Glynn said that:

---

<sup>14</sup>*Ministère de la défense/État-major de l'armée de terre/Service historique (AAT), 7N1927, Manoeuvres de Picardie 1910* (Paris: Imprimerie Nationale); and Carlier, pp. 129-192.

<sup>15</sup>Carlier, *Sera maître du monde*, pp. 223-247.

<sup>16</sup>Raleigh, *The War in the Air, Volume I*, p. 177.

<sup>17</sup>Ibid.

For the last five years the Germans have concentrated their whole attention upon the building, manoeuvring, and employment with troop, of dirigibles. They have gained a slight advance of France, in fact, in this branch of aeronautics; but they have quite dropped behind in the question of heavier-than-air machines.<sup>18</sup>

The German Great General Staff led by General Helmuth von Moltke (the Younger) took this deficiency very seriously. Reports of the success of aviation at the French Picardy manoeuvres in 1910, together with the prospect of war in 1911 during the second Moroccan crisis, proved to be the spur that the German War Ministry needed. Lieutenant Glynn's report was accurate; at the end of 1911 the German army possessed just 30 aeroplanes. These were used for the first time during the 1911 Autumn *Kaisermanöver*, after which chief-of-staff General von Moltke became a strong sponsor of the rapid expansion in the number of heavier-than-air machines. He lobbied for extra funding for aviation to be put into the 1912 Army Bill, and called for an additional 112 aircraft to be purchased.<sup>19</sup> However the reactionary element in the War Ministry decided to buy just 34, chiefly one suspects because they had the Zeppelin.<sup>20</sup> The Germans were also initially disadvantaged by their lack of an aero-engine to rival the French *Antoinette* and *Gnôme* rotary. They resorted in the end to buying, in 1911, the Austrian Daimler automobile engine and building it under licence.<sup>21</sup> In 1912 they invited Karl Benz, another motorcar manufacturer, to develop a bespoke aero-engine, whilst in the meantime the Oberursel Company from Frankfurt-am-Main was copying the French *Gnôme*. By the summer of 1912, according to further information gained by the British, the evidence of Germany's response to the challenge of potential air supremacy was already evident. Delegates from the British Technical sub-committee of the Committee of Imperial Defence had seen this for themselves when they visited five aeroplane factories in Germany – Rumpler, Etrich, Albatros, Harland, and Fokker.<sup>22</sup> Germany had the private industrial capability to build fit-for-purpose warplanes. From 1912 onwards General von Moltke, despite that initial push-back from the War Ministry, provided the heavyweight commitment to purchase them and incorporate them into the order of battle. He wrote on 3 December 1912 that:

The annual reports of the Inspector-General of Foot Artillery (Ill.62375/12 of 8/11/1912) and the Inspector of Field Artillery (I.3740/12, Secret, of

---

<sup>18</sup>Ibid.

<sup>19</sup>Simon. J. House, *Lost Opportunity: the Battle of the Ardennes, 22 August 1914* (Solihull: Helion & Company, 2017), p. 203.

<sup>20</sup>Morrow, *The Great War in the Air*, pp. 19-20.

<sup>21</sup>Ibid., p. 15.

<sup>22</sup>Raleigh, *The War in the Air, Volume I*, p. 180.



## THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

26/10/1912), which I have now received, both show plainly that officers controlling artillery fire will be very materially assisted by spotting and observation from aircraft.<sup>23</sup>

Von Moltke's commitment was crucial. He called for an air force of at least 324 planes, writing that 'I therefore adhere to my former standpoint, that my programme must be carried into effect by 1 April 1914. Please see that this is done.'<sup>24</sup> With such high-level backing, it is no surprise that the German government's expenditure on aviation increased exponentially with the Armament Bills of 1912 and 1913, and the German aviation industry's production capacity with it. From a slow beginning, by the end of 1913 the German Army had procured 628 aeroplanes (of all types including trainers), at precisely the time that, as we shall see below, French aircraft procurement went into the doldrums.<sup>25</sup>

Records show that by 1912, albeit two years behind the French, German aeroplanes were being used to scout for ground troops in manoeuvres. In Germany, most of the really effective training came from day-to-day corps manoeuvres rather than the grand spectacle of the *Kaisermanöver*, to which the world was invited to observe. Each corps had its own large exercise ground, so there were probably many exercises involving aeroplanes, although few records survived the British bombing of the archives in Potsdam in 1945. One surviving record is of the August 1912 reconnaissance exercises between XIII Corps and XVIII Corps. The exercise involved reconnaissance cavalry advancing into contact, with a number of aeroplanes in support. The umpire's conclusion was that 'the fliers did not prove themselves; the Blue side did not put in an appearance and the Red side had eight defective motors before they even got near the enemy'.<sup>26</sup> However as we shall see, two year's practice later, in August 1914, it was a different story.

We have seen, above, how crucial was the support of von Moltke in obtaining funding and aeroplanes for the army up to this point. Arguably, equally important was his role in bringing military aviation into the fold of the army's scheme of 'inspectorates', setting up a new Aviation Inspectorate within General von Hoepfner's Inspectorate of Military Communications.<sup>27</sup> It is noteworthy that von Moltke saw aerial reconnaissance as the province of 'military communications' rather than (as the French) an ownership contest between engineering and artillery.

---

<sup>23</sup>General Ludendorff, *The General Staff and its Problems, Vol. I*, translated by F. A. Holt (London: Hutchinson, 1920), p. 47.

<sup>24</sup>*Ibid.*, p. 43.

<sup>25</sup>M. Cooper, *The Birth of Independent Air Power* (London: Allen & Unwin, 1986), p. 9.

<sup>26</sup>Bundesarchiv/Militärarchiv (BA/MA), Freiburg-im-Breslau, PH 6 I/200.

<sup>27</sup>House, *Lost Opportunity*, pp. 202-205.

Furthermore von Moltke's decision was immediately implemented, not fought over by bureaucrats. The clarity and leadership given from the top of the German army gave direction and impetus to the last-minute development of military aviation doctrine: dirigibles would be used for strategic reconnaissance, and would be held at OHL (Supreme Command) level; heavier-than-air machines would fill in at the operational and battlefield tactical level. The purchase of 'stolid, slow, stable airplanes' was preferred.<sup>28</sup> The bulk of the available aeroplanes would be allocated at army corps level - one *Staffel* of six planes per regular army corps - for tactical reconnaissance and for observation and spotting for heavy artillery. The impetus did not let up on the eve of war. Records show that from 17 to 25 May 1914 competitions were held to determine the relative merits of the latest LDV biplane compared to the A.E.G, Albatros and Aviatik models.<sup>29</sup> Furthermore it is clear that by the spring of 1914 the German War Ministry had bought into the long-term future of heavier-than-air fighting machines. 'By early 1914 the army was reckoning on the eight German aircraft manufacturers producing 100 planes a month on a regular basis', with an order for the mass-production of Benz aero-engines to power them.<sup>30</sup> Thanks to the sustained effort and steady expansion throughout 1912 to 1914, the German air force was in a good position when it went to war.

Following von Moltke's intervention in German military aviation policy in 1911-1912, the race for competitive advantage intensified, but with the French having a clear two-year lead. However a downside to General Roques' bureaucratic victory over Colonel Estienne had already appeared in French policy: he who owned the technological development determined the role that aircraft would play in war. The artillery wanted a practical short-range, stable observation platform, whereas the engineers were interested in building aircraft that would fly faster, higher and further than ever before. In a clear demonstration of their understanding of the key issue at stake, senior staff officers at the War Ministry at first (in 1910-11) had tried to resolve the internal dispute by allowing Estienne's artillery air arm at Vincennes, with its five aircraft, to keep ownership of short-range spotter planes, whilst Roques' Engineering Aviation Inspectorate would take ownership of long-range reconnaissance craft.<sup>31</sup> But Roques objected to this compromise. There was a bureaucratic tussle, at the end of which Roques won complete ownership of military aviation. Predictably one of his first decisions as Inspector of Military Aviation was to announce a 300km speed trial to determine France's best three-seat long-range

---

<sup>28</sup>Morrow, *The Great War in the Air*, p. 19.

<sup>29</sup>Raleigh, *The War in the Air, Volume I*, p. 275.

<sup>30</sup>Morrow, *The Great War in the Air*, p. 14.

<sup>31</sup>*Ibid.*, pp. 13-14.

## THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

reconnaissance machine.<sup>32</sup> Focus turned away from tactical artillery spotting to strategic reconnaissance. The internal dispute, however, rumbled on.

In the short term, all seemed well. Aeroplanes played a prominent part in every French annual autumn manoeuvre: in 1911 '(t)he fall [autumn] manoeuvres [sic] demonstrated that airplanes could locate an enemy's exact position at 60 kilometers and that two-seaters were superior to single-seat for reconnaissance; they also suggested the need for squadrons organized by type' – which facilitated repair and maintenance – 'which were introduced in 1912'.<sup>33</sup> Organising aircraft into squadrons suggests that the French air force was close to achieving critical mass; and the fact that the army ordered 208 planes in 1910–11 (157 of which had been delivered before the end of 1911) supports this hypothesis.<sup>34</sup> There were of course technological problems in the early days, chiefly mechanical failures, such that Foch allegedly remarked in 1913 that 'airplanes are interesting toys, but of no military value', a remark which (if true) undoubtedly came back to haunt him. But the fledgling air force persevered. In 1913, during the Languedoc manoeuvres, General Pau (Blue Army) used his planes to great effect, spotting for his artillery as well as reporting on General Chomer's Red Army movements.<sup>35</sup>

Unfortunately for the prospects of the French air force in the event of an early war, the bureaucratic in-fighting between the artillery and engineers broke out again in April 1912 when General Roques moved on to take up a field command in charge of 7 Infantry Division. An artillery officer, General Bernard, was given command of the Military Aviation Inspectorate after another lengthy political battle. Bernard immediately attempted to return to a policy of using aircraft primarily for artillery spotting instead of long-range reconnaissance missions, insisting – on Colonel Estienne's advice – on the production of armoured planes capable of withstanding rifle and machine-gun fire from the ground. However, existing aero-engines were not at that time powerful enough to bear the extra weight, and while that problem was being solved, production of existing types of aeroplane slowed markedly.<sup>36</sup> Furthermore the development of a coherent doctrine was equally bedevilled by argument. It was unfortunate that the French air force attempted to execute this change of policy direction on the eve of war, and managed to descend into bureaucratic chaos instead of concentrating on producing a fit-for-purpose doctrine,

---

<sup>32</sup>Ibid., p. 15.

<sup>33</sup>Ibid., p. 15.

<sup>34</sup>Ibid., p. 16.

<sup>35</sup>H. C. Johnson, *Breakthrough: Tactics, Technology and the Search for Victory on the Western Front in World War I* (Novato, Ca: Presidio, 1994), p. 18.

<sup>36</sup>Morrow, *The Great War in the Air*, pp. 30-33.

organization and training programme. In short, the French air force had by early 1914 lost its initial advantage, and went to war in a state of disarray.

### **Application in War, August 1914**

In August 1914, France mobilised 138 aircraft and Germany 220.<sup>37</sup> These figures demonstrate how effectively Germany had caught up and indeed outstripped France in aircraft production and military procurement. The disparity in numbers also influenced the deployment and organization of aerial assets in the field. The French, with twenty-three *escadrilles* (of six planes each) but twenty-two army corps and a penchant for centralized control, opted to place a number of *escadrilles* at the disposal of each army commander. General Joffre's choice of allocation seems to have been influenced by circumstance. Fourth Army in the centre opposite the densely wooded Ardennes, for example, was allocated two *escadrilles* of six planes each, whilst Second Army in the more open terrain of Lorraine had five. There seems to have been no formal instructions issued as to their use, no systems, no processes; the senior air officer of each army air detachment was simply attached to the staff at army headquarters and left to his or his chief's own devices. The German High Command, with thirty-three squadrons (*Feldflieger-Abteilungen*) of six planes each (plus spares) at its disposal, had allocated one to each of its army corps and three to the cavalry, leaving just one squadron for each of the eight army commanders and none at OHL level, where the Zeppelins were held for strategic reconnaissance.<sup>38</sup> That meant that the bulk of the available planes were used for tactical reconnaissance and artillery spotting at corps and divisional level – exactly as General von Moltke had envisaged and specified from the outset.

Close study of the early Battles of the Frontiers between 7 and 23 August 1914 shows that the German generals arguably made better initial use of their aviation resources.<sup>39</sup> German flyers embedded in each army corps performed valuable close-range spotting and observation work that influenced battlefield decisions. An early example took place on 14 August when a German plane overflew the French 4<sup>th</sup> Dragoon Brigade (General d'Urbal) near Florenville. It seemed to the French that it was signalling to ground troops by firing shots; but it flew too low and was shot down by French riflemen, whereupon its two aviators were captured.<sup>40</sup> A second example took place on 18 August, when a German plane from XV Corps' squadron tracked the advance of the French VIII Corps into Upper Alsace until it was shot

---

<sup>37</sup>House, *Lost Opportunity*, p. 203.

<sup>38</sup>Cooper, *The Birth of Independent Air Power*, p. 9.

<sup>39</sup>House, *Lost Opportunity*, pp. 202-205.

<sup>40</sup>General V. d'Urbal, *Souvenirs et anecdotes de guerre, 1914–1916* (Paris: Berger-Levrault, 1939) pp. 3-26.

## THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

down.<sup>41</sup> Thirdly, the French VIII Corps commander, General Castelli, later wrote that on 20 August at 14.00 a German aeroplane flew over his headquarters and shortly afterwards heavy calibre shells ‘came crashing down’.<sup>42</sup> These three examples indicate that the doctrine laid out by von Moltke before the war was in fact executed, and point towards a general ability of German air reconnaissance between 3 and 30 August 1914 to lend significant support to their troops on the ground.

On the French side, the best surviving primary source for army use of aviation assets in August 1914 is the autobiography of General (then Captain) Armengaud, who led one of Second Army’s *escadrilles* and was army commander General de Castelnau’s favourite flyer.<sup>43</sup> He and his men were attached to Second Army’s general staff, and when not flying took part in the work of preparing and executing orders and instructions for the ground troops, like ordinary staff officers. He says that this close involvement with ‘normal’ staff work promoted better relations with the staff, which is probably true. But on the other hand, there would have been a distinct possibility, in times of urgency, pressure and stress, that the chief of staff might co-opt the officer-observers into use in the Operations Bureau, to the detriment of their primary reconnaissance role. General Castelnau was according to his biographer ‘one who understood the use of aeroplanes’, unlike General Foch’s chief of staff, Colonel Duchêne, who reputedly told Captain Armengaud: ‘I find your reports ridiculous – *je me moque de vos renseignements*’.<sup>44</sup> But even such an advocate and keen user of aeroplanes as Castelnau seems to have struggled to find the right formula for battlefield use. He wrote that ‘the new air arm was an unknown, without written doctrine on its characteristics, use or type of work – it was known vaguely that it was to be used for scouting’.<sup>45</sup> Despite his complaint about the lack of an air doctrine, Castelnau used his planes to good effect in the operational role: on 25 August, as he finalized his plans for his counterattack on the German VI Army advancing into the ‘Charmes Gap’ south of Nancy: he waited until his airmen had confirmed the continued march south of his enemy before confirming his orders for the attack.<sup>46</sup> Other French army commanders also used their aeroplanes on a regular and frequent basis, if with less success and yet always in an operational role; that is to say for medium- to long-range flights intended to cover the area one or two days’ march ahead of the army. General de Langle de Cary (Fourth Army) put the lack of

---

<sup>41</sup>Captain E. Dupuy, *La Guerre dans les Vosges: 41e division d’infanterie, 1 août 1914– 16 juin 1916* (Paris: Payot, 1936). p. 22.

<sup>42</sup>General de Castelli, *Cinq journées au 8e corps* (Paris: Berger-Levrault, 1930). p. 22.

<sup>43</sup>General Armengaud, *Renseignement aérien* (Paris: Librairie Aéronautique, 1931).

<sup>44</sup>General Yves Gras, *Castelnau: ou l’art de commander, 1851–1944* (Paris: Editions Denoël, 1990), Chapter VIII, pp. 147-74.

<sup>45</sup>*Ibid.*, p. 156.

<sup>46</sup>*Ibid.*, p. 162.

success of his twelve airmen squarely on the difficult terrain of the Ardennes: 'Our troops were to find themselves in wooded areas clashing with unforeseen defenses which our cavalry and our occasional aeroplane had been unable to discover.'<sup>47</sup> The use of the phrase 'our occasional aeroplane' by the man who directly commanded those aeroplanes plainly denotes a lack of ownership and of understanding, and is symptomatic of the key difference between French and German performance. To be fair to the French, it appears that even in the first weeks of the war, German ground troops showed themselves to be adept at concealing themselves in towns, villages and forests as soon as an aircraft was spotted on the horizon. So, between 16 and 21 August, the flyers attached to General Ruffey's Third Army failed to locate and report the divisions of the German Fifth Army that were but a day's march in front of them, reporting instead that the terrain was absolutely empty of enemy forces. The classic example is that contained in the French HQ's evening Intelligence bulletin on 20 August, which reported that aerial reconnaissance had reported no movement around Longwy, when in fact two German corps were conducting short marches through the area and a brigade detachment under General Kaempffer was preparing to lay siege to the fortress.<sup>48</sup> On 22 August, 3<sup>e</sup> Colonial Infantry Division clashed with a German division in the Forest of Rossignol, unaware of the enemy's approach: 'Neither our rather rare aerial reconnaissances nor the divisions of cavalry had succeeded in piercing the veil – the woods kept their secret'.<sup>49</sup> The general failure of French air reconnaissance between 3 and 30 August 1914 was a significant contributory factor in the defeats suffered by their troops on the ground.

The difference in performance – that is to say the application of doctrine and use of technology – between the French and German air forces in the first battles of the war is well exemplified in the Battle of the Ardennes on 22 August 1914. In this battle, French General de Langle de Cary had been ordered to march his Fourth Army due north through the inhospitable forests and hills of the Ardennes in order to seek out, discover, engage and destroy the German forces (described by French Intelligence as the 'Northern Group') beyond the northern forest edge. The German 'Northern Group' consisted in fact of four armies, three of which were engaged in the implementation of the so-called Schlieffen Plan, crossing the river Meuse in order to march through Belgium, around the French left flank, in a great encircling move. The fourth army in that Northern Group – in fact the German Fourth Army under

---

<sup>47</sup>General de Langle de Cary, *Souvenirs de commandement 1914–16* (Paris: Payot, 1935), p. 13.

<sup>48</sup>Ministère de la guerre/État-major de l'armée/Service historique: *Les Armées françaises dans la grande guerre* (AFGG) Volume I, Annex 581: *Bulletin de renseignements du 20 août, 18 heures*; and House, *Lost Opportunity*, pp. 39-40 & p. 64.

<sup>49</sup>General Puyperoux, *La 3<sup>me</sup> division coloniale dans la grande guerre* (Paris: L. Fournier, 1919).

## THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

General Duke Albrecht von Württemberg - had been given the task of remaining on the right bank of the river Meuse and defending the flank of the main German advance. Hence the clash of the French and German Fourth armies was more or less inevitable, given the converging direction of their marches. Furthermore, given the closing distance between the two sides – starting over 35 miles apart – and the paucity of accurate, up-to-date intelligence about each other's dispositions, aerial reconnaissance was likely to be a decisive factor.

De Langle's advance began early in the morning of 22 August 1914. The whole of the Ardennes was covered by a thick fog; there had been rain the day before and as the sun rose, river valley mist reduced even ground visibility to a matter of yards/metres. There was no possibility of flying – by either side – until the fog cleared, which it did from about 09.00 onwards. De Langle had been given two *escadrilles* of six aeroplanes each, for a total of twelve, Duke Albrecht had four *Staffeln*, also of six aeroplanes each, under his overall command. De Langle kept all his twelve aircraft under his direct control, whereas Duke Albrecht retained merely six, with the other three squadrons (18 aircraft) reporting directly to the commanders of his three regular (*aktiv*) army corps. As we shall see, the different dispositions made a major contribution to the way that aerial reconnaissance affected the battle.

Let us take the German side first. The official history records that the Fourth Army staff's six aeroplanes took off at 09.00 as soon as the fog started lifting. Within three hours, at about noon, Duke Albrecht had received the reports from these first flights, despite being away from his headquarters visiting the front. His aircraft had, crucially, spotted the advancing French columns on his right flank that had penetrated deep into the Ardennes and threatened to outflank him.<sup>50</sup> Thanks to the prompt, accurate reports from the aerial observers, Duke Albrecht was able to issue orders to his corps commanders to nullify the French threat.

On the French side, there is in the archive just a single aerial reconnaissance report for the Fourth Army dated 22 August, of a flight that took off at about 16.30; it is worth quoting in full:

At 17.25 heavy fighting was observed on an irregular front oriented generally from south-east to north-west in the region of Framont/Maissin.<sup>51</sup> There was an artillery group concentrated south of the woods to the south of Paliseul

---

<sup>50</sup>House, *Lost Opportunity*, p. 51.

<sup>51</sup>These villages were on the extreme left wing of the French Fourth Army's deployment and the extreme right of the German Fourth Army; in other words the vital area from which a French attempt at envelopment might have developed, if so ordered by de Langle.

railway station, which seemed to me to belong to our cavalry division. The villages of Ochamps, Glaireuse, Anloy were occupied. The triangle Bouillon, Tellin, Pendrôme, Gédinne did not appear to be occupied, the roads being deserted; but from 1,400 metres altitude the cloud cover and mist made observation difficult.<sup>52</sup> The above is however my impression. 6h.30 [18.30] return to Stenay.<sup>53</sup>

This record is remarkable on many counts. It is, given the tenor of the Official History regarding de Langle's lamentable lack of knowledge of what was going on, and in the absence of any other reports in the archive, likely to have been the only French Fourth Army reconnaissance flight that day. The official narrative states that de Langle was 'singularly uninformed' and that until 16.45 he was still under the impression that his left wing was progressing well when in fact one of his army corps was on the point of its retreat turning into a rout.<sup>54</sup> And that sole aerial report was received too late in the day to have been of any use to de Langle in directing his battle. Furthermore the French pilot flew high and over long distances, suggesting an operational or even strategic reconnaissance, rather than risking low-level flight to gain more precise information of a tactical nature. It also confirms a more general point that German troops were already adept at concealing themselves from observation of high-flying French aeroplanes by abandoning roads and waiting in woods, villages and other cover until the aeroplane had flown on: there was at least a brigade of German troops (more than 3,000 men) in the 'unoccupied triangle' over which lieutenant Gouin flew.<sup>55</sup> The poor quality of command and control over French military aviation, and of the pilots' and observers' performance during the first month of the war is clear and evidenced; and it compares badly with that on the German side.

When one looks at the tactical application of aerial observation during the battle of the Ardennes, the comparison worsens. Given the glowing reports in 1911 of French proficiency in ground-to-air co-operation during exercises at the Camp at Châlons, the deterioration is hard to understand or explain unless one looks to a systematic failure by the French high command to properly prepare for war. De Langle did not devolve control of any of his six aircraft to any of his five army corps commanders,

---

<sup>52</sup>These villages were behind the German Fourth Army's right flank; in other words the area into which a French enveloping move would have marched, if so ordered by de Langle.

<sup>53</sup>AFGG I/1, Annex 867: 'Aviateur lieutenant Gouin à Monsieur le général commandant l'armée; le 22 août 1914'.

<sup>54</sup>House, *Lost Opportunity*, pp. 53, 59, 125.

<sup>55</sup>H. Kaiser, *Deutsche und Französische Artillerie in der Schlacht bei Bertrix* (Hanau: Weisenhaus-Buchdruckerie, 1937), p. 33.



## THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

nor did he choose, it seems, to use any aircraft in the tactical role; and this despite the paucity of accurate intelligence flowing into his headquarters. Duke Albrecht, on the other hand, started with an organisation in which a *Staffel* of six aircraft was permanently under the command of his three regular corps commanders. Each corps commander directed his own aircraft, with significant results.

During the combat at Bertrix, a French divisional general failed to locate a strong enemy column advancing into his open flank; consequently the whole of his artillery was wiped out and his infantry decimated. A simple low-level flight by one of de Langle's aircraft might have avoided that catastrophe. His opponent, a German divisional general supported by his corps commander, had at his disposal a single reconnaissance aircraft that, having located the French column, tracked it and reported on its progress. So reliant on this form of reconnaissance was the German general that in his subsequent report he bemoaned the shooting down of his aerial scout, blaming the loss upon his subsequent surprise at the eventual time and place of the contact/engagement.<sup>56</sup>

The staff of a German army corps (and this is a general point) seem to have been in the habit of using makeshift landing strips in fields as close as possible to – sometimes alongside – the corps headquarters, marking the strip with ribbons of white cloth.<sup>57</sup> The French army (and incidentally the British) utilised army aerodromes, sometimes many kilometres away from the headquarters that they served, thus introducing an unnecessary element of delay (and several unnecessary layers of bureaucratic management) into the process of delivering aerial intelligence to the unit commander.

Following the Battle of the Marne, the battles of the Frontiers came to an end, and so too the war of movement. From 15 September onwards, with each side seeking an open flank around which to manoeuvre, the fighting extended steadily northwards until the front reached the sea. By Christmas 1914 an almost continuous line of trenches stretched from the Channel to the Swiss border. The days of marching and manoeuvre were gone, and with it the earliest role of long-range observation planes and dirigibles. From then on, the generals required intelligence about what was going on – in detail – in the static trenches, in the gun lines behind them, and on the roads and railheads that supplied the front line. With static targets and trench lines lacking depth (at least in 1915), the job of the observation plane got both easier and more difficult. It was easier to locate your target, but it was impossible to hide (except in cloud), with many aircraft concentrating into narrow and predictable spaces; and counter-measures were not long in coming.

---

<sup>56</sup>Kaiser, *Deutsche und Französische Artillerie*, p. 33.

<sup>57</sup>BA/MA, PH6-I series.

In the very early days, man's natural aggression had led some observers to carry pistols and rifles and exchange pot-shots with enemy reconnaissance craft. The first French air-to-air victory came on 5 October 1914 when Corporal Louis Quénault, an observer in a *Voisin III* flown by Sergeant Joseph Franz, shot down a German *Aviatik*. The *Voisin III* was a pusher biplane, and Quénault used a Hotchkiss machine gun mounted in the observer's position in the front.<sup>58</sup> These early aerial combats were spontaneous, originating from individual soldier-airmen according to their inclination. However it was not long before an organized and systematic approach to hunting down the enemy was developed. Indeed the innovative technological groundwork for 'hunters' or 'fighters' as they became known had been laid before the war. The first 'pursuit' squadrons were formed over the winter of 1914–15, and in the spring of 1915 the organised hunting of enemy observation planes began in earnest.

To progress beyond the use of revolvers, rifles and light-machine guns required further innovation. It was generally decided that the best type of 'pursuit' plane was the smaller, faster, more manoeuvrable single-seaters, with the pilot simply pointing the plane's nose at the enemy. However the only way that a heavier weapon like the Maxim, Hotchkiss or Vickers gun could be carried on a 1914–15 type plane was on the fuselage, and that meant either placing the engine at the back (known as a 'pusher' type) or firing through the propeller. Reference has been made to August Euler's patent in 1910 for a synchronized machine gun. Another such was Franz Schneider, a Swiss engineer who worked first for the French *Nieuport* company and then for Germany's *LVG*. He first patented his synchronization device on 15 July 1913, and full details were published in the aviation periodical *Flugsport* in September 1914.<sup>59</sup> However the German War Ministry ignored the idea until forced to take action. It took one final maverick innovation to catalyse the warring powers into taking the final step towards the formalization of aerial combat. On 1 April 1915, French fighter pilot Roland Garros shot down an observation plane by firing a machine gun through his propeller – without interrupter gear. He used steel wedges on the back of the wooden blades to deflect those bullets that would otherwise have shattered them. He successfully shot down two more German observation planes over the next few days before crash-landing on 18 April behind German lines. It was only then that Anthony Fokker was commissioned to develop the synchronization device to a point where a Maxim machine gun could be mounted on a Fokker *Eindekker*, firing safely and effectively through the propeller. Soon the 'Fokker Scourge' of 1915 had begun; the Germans shot dozens of British and French

---

<sup>58</sup>Murphy, *Military Aircraft, Origins to 1918*, p. 53.

<sup>59</sup>G. van Wyngarden, *Early German Aces of World War I* (Oxford: Osprey Publishing, 2006).

## THREE-DIMENSIONAL WARFARE – THE INVENTION OF AERIAL COMBAT

observation planes out of the sky, denying the Allies vital reconnaissance intelligence. The concept of air superiority over the battlefield was born, and with it the invention of aerial combat.