

Aircraft performance data for WWI

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Abstract

This document has performance data for WWI aircraft that I have readily available. It will be extended as I obtain more and have the time to enter it. Any errors in transcription are mine. In general I prefer data with serial or other machine/test information. However, the best source is original test data, a primary source, to which I don't have access at the present. Much of the recorded data in secondary sources is partial and sometimes inconsistent. I also will try to list indicative information from memoirs which, although probably uncorrected, should provide information on actual service aircraft. There is at least some limited data for manoeuvrability for some British aircraft.

1 Introduction

During WWI considerable numbers of aircraft types were tested for selection for service use. Despite the limitations of the available equipment and methodology this data is of use. According to JH Morrow [123, p 368] France produced 264 prototypes for 38 service types; the United Kingdom 309 prototypes for 73 service types; and Germany 610 prototypes for 72 service types.

The total aircraft production of the major powers is given by Morrow as [123, p 371]: France 52,000; German 48,000; and UK 43,000. The total aircraft engine productions were: France 88,000; while German and UK production was about 41,000 each. Morrow also gives [123, p 370] for Italy: Fiat built 15,380 six-cylinder water-cooled in-line engines and 1,336 aircraft (Isotta-Frashini and Ansaldo are also mentioned without numbers). Austria-Hungary produced 4,336 engines, see table 1 for more details. Morrow also says [123, pp 373 and 375] that while both sides did much research in fields such as airfoil shape only the Germans tended to apply the results to improve aircraft performance, the French and British tending to rely on more powerful engines for performance. Morrow [123, p 375] says that the Hispano-Suiza had 400 parts compared with the Mercedes 900 parts and weighted one-third less than a Mercedes of equivalent power. Times between engine overhaul are given as 40 hours for rotaries and 100 hours for radials and inlines (in discussion on 1915 [123, p 96]).

Some simple idea of manoeuvrability can be gained by comparing the following three quantities for the aircraft:

$$\text{power loading} = \frac{\text{weight}}{\text{power}}, \quad (1)$$

$$\text{wing loading} = \frac{\text{weight}}{\text{wing area}}, \text{ and} \quad (2)$$

$$\text{aspect ratio} = \frac{\text{wingspan}^2}{\text{wing area}}. \quad (3)$$

Even these simple approaches are complicated by the varying numbers quoted for each quantity in source material. According to Eberhardt [74] the aspect ratio should be corrected for biplanes and monoplanes by multiplying by Monk's span factor K , with $K = 1.1$ (biplanes) and 1.22 (triplanes). There are more sophisticated analyses. For example, see NASA history or the computational aerodynamics in the paper by Eberhardt [74].

According to Winter [149, pp 27–38] the official figures for the British listed 14,166 dead pilots, of whom 8,000 had died while training in the UK. The British training system seemed particularly poor with German training deaths being about 25% of those on active service. The British figures show one death per 90 hours before the Smith-Barry training reforms in 1917 and one per 192 hours after. The Smith-Barry training reforms and Gosport School of Special Fling are described positively by Harold Balfour [5, pp 98–114], Norman MacMillan [117, chapter XV], Arthur Gould Lee [114, p 206] and [116, pp 95–96]. The French training system is described positively by James McConnell [118, chapter IV] and Carroll Winslow [148, pp 14–73, 116–123].

Table 1: Aircraft and Engine production during WWI, the main source is Morrow [123, pp 66–67, 78, 85, 102, 112, 122, 125, 127, 129, 144, 162, 164, 185, 189, 192, 194, 214, 233, 251, 261, 263, 294, 329, 332, 335]. The 1918 German figures [123, pp 305–307] for aircraft are for the months January–July plus October, those for engines are for January–July only. The other months are not obviously disclosed. The United States figures are from a section titled ‘Airplane Production in U.S. 1917 and 1918’, pages 512–518 of a document found as US archives Record Group 18 Entry 219 Box 12.

Year	France		Germany		United Kingdom		Austria-Hungary		Italy		Russia		United States	
	Aircraft	Engines	Aircraft	Engines	Aircraft	Engines	Aircraft	Engines	Aircraft	Engines	Aircraft	Engines	Aircraft	Engines
1914	541	860			193	99	64							
1915	4489	7096	4532	5037	1680	1721	281	440	382	606		851		
1916	7549	16875	8181	7823	5716	5363	807		1255		1769			
1917	14915	23092	13977	12029	13766	11763	1272	1230	3861	6276			1807	
1918	24652	44563	10253	9650	30671	22088	1989	1750	6488	14840			11984	

2 Austria-Hungary

2.1 Brandenburg C.I

The Brandenburg (or Hansa-Brandenburg) C.I was a significant general purpose and reconnaissance two-seat aircraft for the Austrian-Hungarian Empire in 1916–18. The Phönix and UFAG firms were major manufacturer of these aircraft. The main source used here is Grosz et al. [90, pp 95–109, 271–294]. The main engines known to have been used were the 160 hp Austro-Daimler; and 200 hp Hiero; 200 hp Austro-Daimler; 160 hp Mercedes; and 230 hp Hiero. The performance data is given in table 2.

2.2 Brandenburg D.I

The Brandenburg (or Hansa-Brandenburg) D.I was a significant fighter for the Austrian-Hungarian Empire in 1916–17, it was often known as the ‘starstrutter’. The Phönix firm was the major manufacturer of these aircraft. The main sources used here are Taylor [139, pp 46–47] and Grosz et al. [90, pp 115–118]. The main engines known to have been used were the 160 hp Austro-Daimler (Phönix, series 28) and 185 hp Austro-Daimler (Ufag, series 65). The performance data is given in table 3.

2.3 Oeffag Albatros D.II(Oef) and D.III(Oef)

The Oeffag Albatros D.II was a minor fighter and the D.III(Oef) was a significant fighter for the Austro-Hungarian Empire in 1917–18. Oeffag secured licence rights from the Albatros company and their D.II differed little from the original, however the D.III(Oef) incorporated significant changes including strengthening of the wing cellule and airframe. The D.III(Oef) appears to have been free of the German D.III and D.V problem of wing failure. The main reference used is Grosz et al. [90, pp 245–259]. Engines known to have been used include: 185 hp Austro-Daimler; 200 hp Austro-Daimler; 225 hp Austro-Daimler. Performance figures are given in table 4.

2.4 Ö. Aviatik (Berg) DI

The Ö. Aviatik (Berg) DI was a significant fighter for the Austro-Hungarian Empire in 1917–18. The aircraft was less popular than the contemporary Oeffag built Albatros D.III. The main references used are Haddow [91] and Grosz et al. [90, pp 173–188]. Engines known to have been used include: 185 hp Austro-Daimler, series 3B; 200 hp Austro-Daimler, series 138 115, 101 92, 184; 210 hp Austro-Daimler series 238; 225 hp Austro-Daimler, series 338, 284, 384. Performance figures are given in table 5.

2.5 Phönix C.I

The Phönix C.I was a significant general purpose two-seater aircraft for the Austrian-Hungarian Empire. The Phönix C.I was introduced into service in April–May 1918. It was preferred for reconnaissance work. The main source used here is Grosz et al. [90, pp 109–114]. Engines known to have been used are: 230 hp Hiero. The performance data is given in table 6.

2.6 Phönix D.I–D.IV

The Phönix scouts (D.I–D.IV) were a significant fighter for the Austrian-Hungarian Empire in 1917–18, they were used after the Armistice by Sweden. The design was an improvement based on late models of the ‘starstrutter’. The Phönix D.I–D.II saw service during WWI, the D.III and D.IV had not entered service by the end of the war. The main sources used here are Haddow [92] and Grosz et al. [90, pp 118–128]. Engines known to have been used are: 185 hp Austro-Daimler; 200 hp Hiero; 230 hp Hiero; and 230 hp Austro-Daimler. The performance data is given in table 7.

2.7 UFAG C.I

The UFAG C.I was a significant general purpose two-seater aircraft for the Austrian-Hungarian Empire in 1918. It was used for wireless, bombing and photographic work. The main sources used here are Grosz et al. [90, pp 290–294]. Engines known to have been used are: 200 hp Hiero; and 230 hp Hiero. The performance data is given in table 8.

3 France

Most French test reports were produced by the Section Technique Aéronautique (STAé). This includes reports on captured aircraft. From pictures this seemed to be a sophisticated measuring approach, for the period, involving a large standard pitot tube and barometer.

Hooton [104, p 86] states the French lacked bombs larger than 50 kg bombs. Some bomb sizes mentioned are 120 mm (10 kg) bombs, 200 mm (50 kg) and 115 mm (8 kg).

Table 2: Brandenburg (or Hausa-Brandenburg) C.I performance figures. The main source is Grosz et al. [90, pp 95–107, 271–288]. Some models were used as bombers.

Model	C.I(Ph)	C.I(Ph)	C.I(Ph)	C.I(Ph)	C.I(Ph)	C.I(Ph)	C.I(U)	C.I(U)	C.I(U)	C.I(U)	C.I(U)	C.I(U)	C.I(U)	C.I(U)	C.I(U)	C.I(U)	C.I(U)	C.I(U)
Series	26	27	29.5	129 & 229	29	329	61	64	68	63	67	69	169	269	369			
Engine	160 hp A.D	160 hp A.D	200 hp Hiero	200 hp Hiero	200 hp A.D.	200 hp Hiero	160 hp Daimler	160 hp Daimler	160 hp Daimler	160 hp Mercedes	160 hp Daimler	200 hp Hiero	250 hp Benz(Mar)	200 hp Daimler	230 hp Hiero			
Weights (kg):																		
Empty	797	778	805	794	811	803	771	797	794	789	799	930	827	880				
Loaded	1238	1219	1238	1230	1260	1256	1213	1244	1247	1236	1251	1381	1278	1331				
Max speed (kph):	140–145	141–148	155–163	155–159	154	145	138	138–140	143–146	142	154	168–177	160	155–158	160–165			
Climb to (min):																		
1000 m	6 20	5 30	4 12	3 58	4 50	4 30	5 40	6 55	5 28	6 53	5 05	5 24	4 15	4 30	4 00			
2000 m			9 42			8 55												
3000 m		26 05	17 36			13 55						16–18	18–19	14–16				
4000 m			30 10			18 55												
5000 m			54 40										50–55	50–58	48–55			
Service Ceiling (m)																		
Endurance (hrs)																		

Table 3: Hansa-Brandenburg D.I performance figures. The main sources are Taylor [139, p 47] and Grosz et al. [90, p 117].

Model Series	D.I	D.I	D.I(Ph)	D.I(Ph)
Engine	160 hp A.D	185 hp A.D	185 hp A.D	185 hp A.D
Weights (kg):				
Empty			714	690
Loaded	2024 lb	2046 lb	1047	958
Max speed (kph):	116.5 mph		175–185	175–177
Climb to (min):				
1000 m			3 55	4 30
Service Ceiling (m)				
Endurance (hrs)				

Table 4: Oeffag Albatros D.II(Oef) and D.III(Oef) performance figures. The main source is Grosz et al. [90, pp 246, 249, 252 and 257].

Model Series	D.II(Oef)	D.III(Oef)	D.III(Oef)	D.III(Oef)
Engine	185 hp A.D	185 hp A.D.	200 hp A.D.	225 hp A.D
Weights (kg):				
Empty		690	710	722
Loaded	898	964	987	995
Max speed (kph)	170	180	188	202
Climb to (min):				
1000 m	4 30	3 20	2 35	3 05
2000 m	7 00		6 35	7 10
3000 m	12 30	14 30	11 20	11 20
4000 m			18 50	17 15
5000 m		32 00	33 00	27 00
Service Ceiling (m)				
Endurance (hrs)				

3.1 A.R.1 and A.R.2

The Avant Renault A.R.1 and A.R.2, sometimes referred to as the Dorand A.R.1 and A.R.2, were a French two-seat reconnaissance-bombers used by the Aviation Militaire mainly in 1917, there was some limited use by the USAS. The engines known to have been used include: 160 hp Renault; 190 hp Renault 8Gd or 8Gdx; 240 hp Lorraine 8A. The main sources used here are [59, pp 88–90] and Davilla and Soltan [71, pp 37–46]. Performance figures are given in table 9.

- Harold Porter [127, p 335] refers to the A.R.'s the USAS obtained from the French as 'Antique Rattletraps'.
- Elmer Haslett [97, p 40] also refers to the A.R.'s as 'Antique Rattletraps' and says the only good feature was the dependable motor, being 'very slow and did not fly well'.

3.2 Breguet 14

The Breguet 14 was a major two-seat reconnaissance (14A2) and bomber (14B2) for the Aviation Militaire and was also used by the USAS, the Belgians and Greece. The 14 B1 was a single-seat bomber version. The main sources used here Bruce and Noël [60] and Davilla and Soltan [71, pp 101–126]. The Breguet 14 is notable for the widespread use of metal, particularly duralumin for longerons and spacers plus the wing spars. For photo-reconnaissance the Breguet 14 used the 26 cm, 50 cm, 120 cm and 26 cm 'Grand Champ' cameras; all with multi-plate magazines and semi-automatic plate changes [76, p 289]. Engines known to have been used include: 263 hp Renault; 272 hp Renault; 220 hp Renault 12Fb; 300 hp Renault 12Fcx (main engine); 310 hp Renault 12Fcy; 320 hp Renault 12Fe; 320 hp Renault 12Fe with Rateau turbo-compressor; 350 hp Renault 12Ff; 400 hp Renault 12K; 260 hp Fiat A-12; 300 hp Fiat A-12*bis*; 600 hp Fiat A-14; 285 hp Lorraine-Dietrich 8Bd; 370 hp

Table 5: Ö. Aviatik (Berg) DI performance figures. The main source is Haddow [91] and Grosz et al. [90, pp 178, 180, 182 and 185].

Series	38	138	238	338			
Engine	185 hp A.D.	185 hp A.D.	200 hp A.D.	200 hp A.D.	160 hp A.D.	225 hp A.D.	225 hp A.D.
Weights (kg):							
Empty		580	610			618	
Military load	50		50			50	
Pilot	80		80			80	
Fuel and oil			88			84	
Water			24			30	
Loaded		850	852			912	
Max speed (mph):							
(kph)	112		115		195	192	127
Climb to (min):							
1000 m	3 12	2 18	2 14	1 42	2 06	1 07	1 59
2000 m	7 38		4 36	4 30	5 50	4 07	4 12
3000 m	12 57	8 04	7 25	7 36	10 12	7 05	7 30
4000 m	18 38		11 17	12 10	15 24	12 00	12 00
5000 m	32 49	20 18		16 26	21 34	16 04	16 24
6000 m			26 05	26 00			27 30
Service Ceiling (ft)							
			20172				
Endurance (hrs)							
			2.5			1.5	

Table 6: Phönix C.I performance figures. The main source is Grosz et al. [90, pp 113]. Up to 6×12 kg bombs could be carried on underwing bomb racks.

Model	C.I
Series	121
Engine	230 hp Hiero
Weights (kg):	
Empty	820
Loaded	1240
Max speed (kph):	
	170–175
Climb to (min):	
1000 m	4 30
2000 m	10 45
3000 m	20 35
4000 m	24 50
5000 m	55 00
Service Ceiling (m)	
Endurance (hrs)	

Table 7: Phönix D.I–D.IV performance figures. The main sources are Haddow [92] and Grosz et al. [90, pp 119, 125 and 128].

Engine	20.14 Exp 185 hp A.D	D.I 200 hp Hiero	D.I 200 hp Hiero	D.II 200 hp Hiero	D.IIa 230 hp Hiero	D.III 230 hp Hiero	D.III 230 hp Hiero	D.IV 230 hp Hiero or A.D.	J.1 Swedish 185 hp BMW
Weights (kg):									
Empty	720	665	716	665		685	685	665	660
Loaded	920	805	951	805		951	951	950	960
Max speed (kph):	175	180	178	180	185	195	185	195	170
Climb to (min):									
1000 m		3 00	3 05	3 00		2 30	2 00	2 10	
2000 m		7 00	7 00	7 00					
3000 m		12 00	12 15	12 00		12 00	12 00		
4000 m			18 39						
5000 m			27 39			18 00	24 00		
Service Ceiling (m)	5000	6000		6000		6800		7500	
Endurance (hrs)						2			3

Table 8: UFAG C.I performance figures. The main source is Grosz et al. [90, pp 292]. Bomb racks for 12×12 kg bombs were fitted.

Model Series Engine	C.I 161.02 230 hp Hiero	C.I First Series 230 hp Hiero	C.I Second Series 230 hp Hiero
Weights (kg):			
Empty	680	730	750
Loaded	1060	1131	1150
Max speed (kph):	180		
Climb to (min):			
1000 m	2 50	3 50	4 05
2000 m		9 05	10 00
3000 m	11 20	16 03	18 35
4000 m		25 52	31 00
Service Ceiling (m)			
Endurance (hrs)			

Table 9: A.R.1 and A.R.2 performance figures. The main sources are JM Bruce [59, pp 88–90] and Davilla and Soltan [71, p 46]. Normal bomb load: 4×120 mm bombs (I understand these to be 10 kg bombs from online references). Wing span (for both types): 13.27 m; wing area: 50.17 m².

Aircraft	A.R.1	A.R.2
Engine	190 hp Renault 8Gd	240 hp Lorraine 8Bb
Weights (kg):		
Empty	810	825
Loaded	1250	1250
Max speed (kph):		
2000 m	152	159
3000 m	147	
4000 m	141	
Climb to (min):		
2000 m	11 00	14.5
3000 m	22 20	28.2
4000 m	39 00	
Service Ceiling (m)	5500	3000
Endurance (hrs)	3	3

Lorraine-Dietrich 12Da; 390 hp Lorraine-Dietrich 12E; 400 hp Liberty; 350 hp Panhard 12C; 340 hp Panhard 12D; 360 hp Rolls-Royce Eagle VIII. Performance figures are given in table 10.

- Harold Porter [127, p 336] considers the Salmsons and Breguets the USAS obtained from the French to be ‘first-rate ships’.

3.3 Caudron G.3 and G.4

The Caudron G.3 and G.4 were a French two-seat reconnaissance and trainer aircraft used by the Aviation Militaire and RFC mainly in 1914–15. For the G.3 the engines known to have been used include: 80 hp Gnome; 80 hp Le Rhône; 70 hp Renault; 80 hp or 100 hp Anzani. The G.4 was a two-engined derivative of the G.3. It was two-seat reconnaissance bomber used by the Aviation Militaire and RNAS derivative of the G.3. The engines known to have been used include: 2×80 hp Le Rhône; 2×100 hp Anzani. The main source used here is [59, pp 191–196]. Performance figures are given in table 11.

3.4 Caudron R.11

The Caudron R.11 was a French three-seat multipurpose aircraft, most notably used as a bomber escort by the Aviation Militaire in 1918. The engines known to have been used include: 200 hp Hispano-Suiza; 215 hp Hispano-Suiza 8Bda; 235 hp Hispano-Suiza 8Beb. The main sources used are JM Bruce [59, pp 196–198] and Davilla and Soltan [71, pp 167–169]. Performance figures are given in table 12.

3.5 Hanriot HD-1

The Hanriot HD-1 was not used by the French Aviation Militaire, though it was used by French naval aviation. In addition it was widely used by the Italian and Belgian services. The HD-1 appeared about the same time as the Spad VII. The leading French pilots were enthusiastic about the Spad and preferred it to the HD-1. The Italian pilots preferred it to the Spad and it was built under licence by Nieuport-Macchi. The HD-1 was the most widely used fighter type by Italian squadrons. The Belgian pilots after some initial dislike came to prefer it to other options. When offered Sopwith Camels early in 1918 most Belgian pilots preferred to keep the HD-1. The main sources used here are JM Bruce [45] and Davilla and Soltan [71, pp 270–272]. Engines used include: 110 hp Le Rhône 9J; 120 hp Le Rhône 9Jb; 130 hp Le Rhône 9Jby; 130 hp Clerget 9B; 150 hp Gnome Monosoupape; 170 hp Le Rhône 9R. Performance figures are given in table 13.

- Willy Coppens [68, pp 120–121] states the Hanriot was extremely easy to handle and pleasant to fly. It was strong, was faster and climbed better than the Nieuport. Willy Coppens would have preferred a second machine gun even at the expense of climbing power and some fuel. Willy Coppens [68, pp 131–134] states that in the course of testing a two machine gun Hanriot it reached 19,600 ft by barograph or 18,400 ft by the altimeter. Willy Coppens [68, p 162] says they frequently crossed the lines at 18,000 ft. Willy Coppens [68, pp 209–210] says he had one Hanriot fitted with a modified Vickers machine-gun of

Table 10: Breguet 14 performance figures. The main sources are Bruce and Noël [60] and Davilla and Soltan [71, pp 124 and 126]. Wing span 14.364 m (without horn balances), 14.860 m (with horn balances); wing area 50.2 m² (with horn balances), 48.5 m² (without horn balances): this appears to be reverse of what should be meant, but is as given by Davilla and Soltan. Bomb load 14B2: up to 32 × 115 mm (8 kg bombs (also describe as 11.5 kg) or equivalent; 14A2: up to 4 × 120 mm bombs.

Engine	300 hp	310 hp	320 hp	320 hp	320 hp	360 hp	300 hp	285 hp	370 hp	400 hp	400 hp	300 hp	400 hp	Breguet 14B2	Breguet 14B1
	Renault 12Fcv	Renault 12Fcy	Renault 12Fe	Renault 12Fe	Renault 12Fe	Renault 12K	Fiat A-12	L-D 8Bc	L-D 12De	Liberty	Renault 12Fcx	Renault 12Fcx	Liberty	Renault 12	Renault 12Fcx
Weights (lb):															
	Empty	2227	2227			2646	2554	2066	2392	2283	2473				
Military load		330	330	331	331	407	331	331	331	780	903				716
Crew		353	353	353	353	353	353	353	353	353	353				176
Fuel and oil		476	476	476	476	604	490	490	694	476	735				1048
Loaded		3386	3386	3389		4090	3736	3248	3770	3092	4464				
Max speed (mph):															
	6500 ft	109	114	116	107	126	104	104	121	110	112				
	10000 ft	107	108	114	101	123	98	101	119	106	110				
	16500 ft	100	102	104	115	113		87	108	113	100				
Climb to (min):															
	6500 ft	6 50	7 40	8 07	9 50	6 09	11 45	9 26	5 20	9 15	8 57				14 19
	10000 ft	11 25	12 10	13 07	16 08	10 19	19 20	15 11	8 50	16 30	14 48				24 44
	15000 ft	29 30	25 40	30 58	28 16	22 28	43 06	43 06	19 20	42 00	41 02				
Service Ceiling (ft)				21000		23000	15000	17000	23000	22000	19000				
Endurance (hrs)		2.5	2.5	3	3	3.7	3	3	3	3	2		4.5		6

Table 11: Caudron G.3 and G.4 performance figures. The main source is JM Bruce [59, pp 191–196].

Aircraft	G.3	G.4
Engine	80 hp Gnome	2 × 80 hp Le Rhône
Weights (kg):		
Empty	435	733
Loaded	710	1232
Max speed (kph):		
Sea level	105	130
2000 m		125
3000 m		124
Climb to (min):		
1000 m		6 30
2000 m	27	15 00
Service Ceiling (m)	3050	4300
Endurance (hrs)	3.5	5

Table 12: Caudron R.11 performance figures. The main sources are JM Bruce [59, pp 196–198] and Davilla and Soltan [71, p 168]. Wing span: 17.92 m (upper), 16.97 m (lower); wing area: 54.25 m². Note the climb to 3000 m for the prototype is given in Davilla and Soltan as 4 minutes 30 seconds, this is undoubtedly a typographic mistake. The time given to 5000 m for the prototype seems likely to be in error.

Engine	prototype 2 × 200 hp HS 8Ba	2 × 215 hp H-S 8Bda
Weights (kg):		
Empty	1416	1422
Loaded	2188	2167
Max speed (kph):		
ground	191	
2000 m	185	183
3000 m	180	178
4000 m	173	173
5000 m		164
Climb to (min):		
1000 m	3 50	
2000 m	8 10	8 10
3000 m	14 30	14 30
4000 m	22 35	22 30
5000 m	25 00	39 00
Service Ceiling (m)		5950
Endurance (hrs)		3

11 mm calibre as compared with the usual 7 mm calibre. This machine was used for balloon busting and one with the usual Vickers for normal patrols.

Table 13: Hanriot HD-1 performance figures. The main source is JM Bruce [45]. The first set of data is from Section Technique de l’Aéronautique. JM Bruce comments that the sources of the second, third and fourth columns have not been discovered. He further comments that the fifth column attributed to the US Navy is too optimistic to be acceptable. Wing span 28 ft 6.4 in (upper), 24 ft 3.25 in (lower); wing area 194.5 ft².

Engine	120 hp Le Rhône 9Jb	120 hp Le Rhône 9Jb?	German report Le Rhône 9Jb	Italian sources 120 hp Clerget	USN 25/6/19 150 hp Monosoupape	Ministry of Munitions table 150 hp Le Rhône	170 hp
Weights (lb):							
Empty	908	882	904	849	1021		
Military load					185		88
Pilot					165		
Fuel and oil					234		
Loaded	1360	1334	1322	1268	1605	1268	1268
Max speed (mph):							
Ground level		114	108.5	110.6	113		
2000 m		110.5	96.3				
4000 m						115	125
Climb to (min):							
1000 m		2 58	3 00	2 40			
2000 m	5 31	6 03	6 00	6 40			
3000 m	9 17	11 03	11 00	11 10	8 30		
4000 m	14 08	19 30	17 00	16 30		13 10	
5000 m	21 30	32 00					
Service Ceiling (ft)	20500	20670		22960			
Endurance (hrs)		2.5		3	2.4	2	2

3.6 Henry Farman

The Henry Farman F.20 was a French two or three-seat pusher aircraft used by the Aviation Militaire early in WWI, it was also used by the RFC on the Western Front in 1914 and later as a trainer. The engines known to have been used include: 80 hp Gnome; 80 hp Le Rhône. The Henry Farman F.27 was a later two or three-seat reconnaissance bomber pusher aircraft also used by the Aviation Militaire, RNAS and the RFC from 1914–18, the latter use was in the middle East and Africa. The Farman F.27 incorporated an all metal structure that made it particularly resistant to degradation in hot climates. The engines used included: 140 hp Gnome; 140 hp Salmson; 160 hp Salmson; 155 hp Canton-Unné R9; 240 hp Renault. The main source used here are [59, pp 229–238] and [71, pp 215–216]. Performance figures are given in table 14.

- Oliver Stewart [15, p 11–13] states that the Henri Farman F.27 performed well in South-West Africa, Dardanelles and the destruction of the Königsberg. He gives the maximum sped as 90 mph and states it could carry a weight of 880 lb.

3.7 Maurice Farman

The Maurice Farman Série 7 (Longhorn) was a French two-seat general purpose aircraft and trainer used by the Aviation Militaire and RFC used in combat in 1914–15. The Maurice Farman Série 11 (Shorthorn) was a French two-seat reconnaissance and trainer aircraft used in combat in 1914–16, latterly in the Middle East. The engines known to have been used by both include: 80 hp Renault. The main source used here is [59, pp 238–246]. Performance figures are given in table 15.

- Duncan Grinnell-Milne [86, p 64] states that in a dive his Shorthorn reached an indicated speed of 70 mph. Duncan Grinnell-Milne [86, p 69] states that around October 1915 he reached an altitude of 11,800 ft after an hour’s climbing in a Shorthorn.

3.8 Morane-Saulnier Type L and LA

The Morane-Saulnier Type L was a French two-seat parasol monoplane reconnaissance aircraft used by the Aviation Militaire, RFC and Russians mainly in 1914–15. Finnegan [76, p 23] records a Morane-Saulnier parasol with internally mounted camera and automatic plate changer being shown at the 1913 Paris Aero Salon,

Table 14: Henry Farman F.20 and F.27 performance figures. The main source are JM Bruce [59, pp 229–38] and Davilla and Soltan [71, pp 215–216]. F.27 bomb load with 155 hp Canton-Unné was up to 250 kg. With the Renault the endurance was given as: 7 hrs (500 kg bomb load); 8 hrs (440 kg); 11 hrs (320 kg); 15 hrs (200 kg). Wing span: 16.147 m; wing area: 62 m².

Aircraft	F.20	F.27	F.27	F.27
Engine			150 hp Canton-Unné	240 hp Renault
Weights (kg):				
Empty	360		770	
Loaded	660		1170	
Max speed (kph):				
Sea level	105	147	147	160
2000 m		145	145	
3000 m		142	142	
Climb to (min):				
500 m	8 00			
2000 m		16 00	12 00	
3000 m		29 00	30 00	
Service Ceiling (m)				
		4800	4800	
Endurance (hrs)				
	3	2.3	2.67	

Table 15: Maurice Farman Série 7 (Longhorn) and Série 11 (Shorthorn) performance figures. The main source is JM Bruce [59, pp 238–246].

Aircraft	Série 7	Série 11
Weights (kg):		
Empty	599	654
Loaded	871	928
Max speed (kph):		
Sea level	105	116
Climb to (min):		
1000 m	15 00	8 00
2000 m	35 00	20 00
Service Ceiling (m)		
Endurance (hrs)		
	5	3.75

presumably this is a type L. Engines known to have been used are: 80 hp Le Rhône 9C; and 80 hp Gnome. Performance figures are given in table 16.

3.9 Morane-Saulnier Types N, I and V

The Morane-Saulnier N, I and V were single-seat monoplane fighters used by the Aviation Militaire and RFC in 1915–16. The engines known to have been used include: 80 hp Le Rhône 9C (Type N); 110 hp Le Rhône 9J. The main source used here is [59, pp 296–303]. Performance figures are given in table 17.

3.10 Morane-Saulnier Type BB

The Morane-Saulnier Type BB was a two-seat reconnaissance biplane used by the Aviation Militaire and RFC mainly in 1916. The engines known to have been used include: 110 hp Le Rhône 9J. The main source used here is [59, pp 303–306]. Performance figures are given in table 18.

3.11 Morane-Saulnier Type P

The Morane-Saulnier Type P was a French two-seat parasol monoplane reconnaissance aircraft used by the Aviation Militaire and RFC mainly in 1916–17. The engines known to have been used include: 110 hp Le Rhône 9J; 80 hp Le Rhône 9C. The main source used here is [59, pp 306–312]. Performance figures are given in table 19.

Table 16: Morane-Saulnier Type L and LA performance figures. The main source is Davilla and Soltan [71, p 318].

Type	L	LA	Russian L	Russian L
Engine	80 hp Le Rhône 9C	80 hp Le Rhône	80 hp Gnome	80 hp Le Rhône
Weights (kg):				
Empty	385	400	375	395
Loaded	650	650	650	670
Max speed (kph):				
Sea Level	125	135	119	127
Climb to (min):				
1000 m	8 00	6 10	8 00	6 00
2000 m	18 30	15 25	18 30	15 00
3000 m		29 25	33 00	
Service Ceiling (m)			3500	
Endurance (hrs)		4	2.5	2.6

Table 17: Morane-Saulnier Types N, I and V performance figures. The main source is JM Bruce [59, pp 88–90].

Aircraft	Type N	Type I	Type V
Weights (lb):			
Empty		334	
Loaded	444	510	
Max speed (kph):			
Sea level	144	168	165
3000 m		156	
Service Ceiling (m)		4700	
Endurance (hrs)		1.5	1 20

Table 18: Morane-Saulnier Type BB performance figures. The main source is JM Bruce [59, pp 303–306].

Engine	110 hp Le Rhône
Weights (kg):	
Empty	491
Loaded	761
Max speed (kph):	
3050 m	134
Climb to (min):	
1980 m	13 00
3050 m	26 48
Service Ceiling (m)	
3660	
Endurance (hrs)	

Table 19: Morane-Saulnier Type P performance figures. The main source is JM Bruce [59, pp 306–312].

Weights (kg):	
Empty	433
Loaded	733
Max speed (kph):	
Sea level	162
2000 m	155.8
Climb to (min):	
2000 m	8 45
3000 m	15 50
Service Ceiling (m)	4800
Endurance (hrs)	2.5

3.12 Morane-Saulnier Type AC

The Morane-Saulnier Type AC was a French single-seat monoplane fighter aircraft used by the Aviation Militaire mainly in 1916–17. The engines known to have been used include: 110 hp Le Rhône 9J; 120 hp Le Rhône 9Jb. The main source used here is [59, pp 312–314]. Performance figures are given in table 20.

Table 20: Morane-Saulnier Type AC performance figures. The main source is JM Bruce [59, pp 312–314].

Weights (kg):	
Empty	435
Loaded	658
Max speed (kph):	
Sea level	178
2000 m	174
3000 m	171
Climb to (min):	
2000 m	5 55
3000 m	10 15
Service Ceiling (m)	5600
Endurance (hrs)	2.5

3.13 Nieuport 11

The Nieuport 11 was a major Aviation Militaire and RNAS single-seat fighter in 1916. The aircraft was also used by Belgium, Romania and Serbia. The aircraft was also produced and used by Italy and Russia. The main source used here is Davilla and Soltan [71, pp 360–365]. Engines known to be used are: 50, 60 or 80 hp Le Rhône 9C. Performance figures are given in table 21.

- Georges Thenault [142, p 27] says the Nieuport 11 with 80 hp Le Rhone could fly at 95 mph.

3.14 Nieuport 12 and 20

The Nieuport 12 was a widely used two-seat reconnaissance aircraft for the Aviation Militaire, RNAS and RFC. The Nieuport 20 a improved version used only by the RFC in limited numbers. Both aircraft had a reputation for excessive vibration, poor performance and being difficult to fly and land. The main sources used here are JM Bruce [59, pp 320–326] and Davilla and Soltan [71, pp 365–369 and 387–388]. Engines known to have been used are (Nieuport 12): 110 hp Clerget 9Z; 100 hp Gnome Monosoupape; 130 hp Clerget 9B; (Nieuport 20): 110 hp Le Rhône 9J. Performance figures are given in table 22.

- Norman Macmillan [117, p 61–2] states that around August 1917a shortage in Sopwith Strutters resulted in 45 Squadron receiving six Nieuports which from JM Bruces book cited above, were Nieuport 20's. The strong points were stated to be the 110 hp Le Rhône being superior to the 130 hp Clerget and the undercarriage being strong. The weak points were view was bad, controls heavy, performance dud and aircraft tail heavy.

Table 21: Nieuport 11 performance figures. The main source is Davilla and Soltan [71, p 364]. Wing span: 7.520 m; wing area: 13.3 m².

Engine	80 hp Le Rhône 9C
Weights (kg):	
Empty	320
Loaded	480
Max speed (kph):	
Sea level	165
2000 m	162
Climb to (min):	
2000 m	8.50
3000 m	15
Service Ceiling (m)	5000
Endurance (hrs)	2.5

Table 22: Nieuport 12 and 20 performance figures. The main sources are JM Bruce [59, pp 387–388] and Davilla and Soltan [71, p 364 and 387]. Wing span 9.00 m; wing area: 22.00 m².

Aircraft	N 12	N 20
Engine	110 hp Clerget 9Z	110 hp Le Rhône 9J
Weights (kg):		
Empty	550	453
Loaded	825	732
Max speed (kph):		
Sea level		157
2000 m	146	152
Climb to (min):		
1000 m	5 40	5 12
2000 m	14 15	
Service Ceiling (m)	4000	
Endurance (hrs)	3	

3.15 Nieuport 16

The Nieuport 16 was a major Aviation Militaire, RNAS and RFC single-seat fighter in 1916. The main sources used here are JM Bruce [59, pp 326–328] and Davilla and Soltan [71, pp 377–378]. It was essentially a Nieuport 11 with a more powerful engine and was reported to be nose-heavy. The Nieuport 16 was initially armed with a top-wing mounted Lewis gun, later the Alkan synchronisation gear allowed some aircraft to have a synchronised Lewis guns mounted on the top decking of the fuselage. Engines known to be used are: 110 hp Le Rhône 9J. Performance figures are given in table 23.

3.16 Nieuport 17 and 23

The Nieuport 17 was a major Aviation Militaire, RNAS and RFC single-seat fighter in 1916–17. The Nieuport 17 was also used by Belgium, Italy, Romania and Russia. French machines were normally armed with a single synchronised Vickers machine gun. It was also produced in Italy and Russia. The Nieuport 23 in French service was mainly distinguished by the Vickers gun being offset to starboard. In the RFC all aircraft were armed with an overwing Lewis gun and the Nieuport 17 and 23 are difficult to tell apart. The main sources used here are CF Andrews [2], JM Bruce [59, pp 328–333] and Davilla and Soltan [71, pp 379–386 and 390–392]. Engines known to be used are: 110 hp Le Rhône 9Ja (Nieuport 17 and 23); 130 hp Clerget (Nieuport 17*bis*); 120 hp Le Rhône 9Jb (Nieuport 23). Performance figures are given in table 24.

- William McLanachan [121, pp 16 & 34] around May 1917 reports flying an Nieuport 17 with 110 hp Le Rhône controlled by a throttle and a mixture lever. The top speed was about 95 mph. The Albatros and

Table 23: Nieuport 16 performance figures. The main sources are JM Bruce [59, pp 326–328] and Davilla and Soltan [71, p 378]. Wing span 7.52 m; wing area: 13.30 m².

Engine	113 hp Le Rhône
Weights (kg):	
Empty	375
Loaded	550
Max speed (kph):	
Sea level	165
2000 m	156
Climb to (min):	
2000 m	5 50
3000 m	10 10
Service Ceiling (m)	4800
Endurance (hrs)	2

Halberstadt were faster than the Nieuport on the level and in a dive. William McLanachan [121, p 180] states that the Nieuport would reach 150 mph in a dive.

- James McConnell [118, p 47] gives the maximum speed for a non-specified model as 110 mph, as the aircraft he flew in combat was the Nieuport 17 (see below) this is assumed to be the Nieuport 17. James McConnell [118, p 47] states the new model Nieuport with 160 ft² of wing area and Vickers gun (hence Nieuport 17) climbed 7,000 ft in six minutes and will climb to 20,000 ft with a good pilot.

3.17 Nieuport 24 and 24bis

The Nieuport 24 was a minor Aviation Militaire and RFC single-seat fighter in 1917. It was also used by Greece and Russia. In French service it was rapidly replaced by the Spad VII. The main sources used here are JM Bruce [59, pp 334–336] and Davilla and Soltan [71, pp 392–398]. Engines known to be used are: 120 hp Le Rhône 9Jb; 130 hp Le Rhône 9Jby. Performance figures are given in table 25.

3.18 Nieuport 27

The Nieuport 27 was a minor Aviation Militaire and RFC single-seat fighter in 1917. It was also used by Italy and the USAS. It was essentially an improved Nieuport 24. In French service it was rapidly replaced by the Spad VII. The main sources used here are JM Bruce [59, pp 337–338] and Davilla and Soltan [71, pp 400–404]. French aircraft had a synchronised Vickers and some had an overwing Lewis gun in addition. RFC aircraft had only overwing Lewis guns. Engines known to be used are: 130 hp Le Rhône 9JB. Performance figures are given in table 26.

- William McLanachan [121, p 129–130] around August 1917 reports flying an Nieuport with two overwing Lewis guns (picture facing 144, which online sources state is a Nieuport 27). William McLanachan [121, p 173] states that his flight did several patrols at about 20,000 ft.

3.19 Nieuport 28

The Nieuport 28 was mostly used by the USAS. The main sources used here are Peter M Bowers [12] and Davilla and Soltan [71, pp 405–408]. The main engine known to be used: 165 hp Gnome Monosoupape 9N and 9Nc. Peter M Bowers states that while Le Rhône engines could be throttled to a degree (from 1250 rpm to 900 rpm) the Gnome engines did not have even this ability. For power adjustment the Gnome engines totally, and the Le Rhône engines partially relied on a ‘Blip Switch’, a cut-off button on the control column that allowed the pilot to switch off the engine for brief intervals. At least some Gnome engines also had additional buttons to cut out one or more cylinders for continuous low-power running (although fouling prevented this period being too long). Part of a flight test is available at this site. Performance figures are given in table 27.

- Edward Rickenbacker [128, pp 32 & 40] states the Nieuport 28 could out-maneuvre the Spad XIII and climbed faster. He also states that the Nieuport 28 could out-climb the Pfalz (Pfalz D.III from context), but the latter could out-dive the Nieuport, particularly given the latter's habit of shedding fabric when diving. Edward Rickenbacker [128, pp 74–81] describes a flight in which his Nieuport reached a height of 20,000 ft, attacked three Albatros D-type scouts by diving at around 200 mph and had a collapse of the right wing and loss of fabric on the top wing. He managed to get the aircraft back to ground safely. Edward Rickenbacker [128, p 109] states he and another pilot reached a patrol height of 22,000 ft. Edward

Table 24: Nieuport 17 and 23 performance figures. The main sources are CF Andrews [2], JM Bruce [59, pp 328–333] and [71, pp 385 and 391]. The figures from Andrews are described as RFC official figures. Nieuport 17: power loading 11.6 lb/hp; wing span 26 ft (upper) 25 ft 7 in (lower); wing area 158.8 ft² (14.75 m²); wing loading 7.75 lb/ft². The 3048 m and 6096 m for the Nieuport 17*bis* seem likely to have originally been British (imperial) measurements.

Aircraft	N 17	N 17	N 17 <i>bis</i>
Engine	113 hp	110 hp	130 hp
	Le Rhône	Le Rhône	Clerget
		9Ja	9B
Weights (kg):			
Empty	825 lb	375	
fuel and oil	143 lb		
pilot and military load	264 lb		
Loaded	1232 lb	560	573
Power loading (lb/hp)	11.6		
Wing loading (lb/ft ²)	7.75		
Max speed (mph):			
6500 ft	107		
10000 ft	101		
Max speed (kph):			
ground level		165	190
500 m			175
2000 m		160	
3000 m		154	
3048 m			172
4000 m		137	
Climb to (min):			
6500 ft	5.5		
10000 ft	9.0		
2000 m		6 50	
3000 m		11 30	
3048 m			9 20
4000 m		18 05	
6096 m			32 00
Service Ceiling (m)	17500 ft	5300	
Endurance (hrs)	2	1.755	

Rickenbacker [128, p 134] borrowed another pilot’s aircraft, Smyth’s, this had two machine guns rather than the one of Rickenbacker’s. Smyth’s Nieuport would only reach 20,000 ft.

- Harold Hartney [95, pp 129–32] describes the Nieuport 28 as a ‘fast moving, fast acting gem’ with a ‘terrible weakness’ in the ‘construction of the leading edge of the top and bottom wings’ which ‘without reinforcing, the fabric came off when pilots pulled out of a steep dive too rapidly’. The aircraft ‘climbed better than the Camels at Gosport’. Harold Hartney [95, p 158] stated the Nieuport 28 had ‘superior manoeuvrability of our faster and better climbing little Nieuports’ compared with the Fokker D.VII, this is in July and likely refers to 160 hp Fokker D.VII. Harold Hartney [95, pp 182–3] states that both 27th and 147th Aero Squadrons were heartbroken when the Nieuport 28 was replaced with the 220 hp Spad XIII. He quotes a British pilot as stating of the Spad XIII that ‘The thing flies like a bloody brick, you know’ and says they agreed with this opinion. His major complaint was serviceability of the Spad XIII at least partly due to problems with the reduction gears. Harold Hartney [95, pp 254] this problem was also common with the French Spads.

3.20 Paul Schmitt 7

The Paul Schmitt 7 was a major Aviation Militaire two-seat bomber aircraft in 1917. It was a modified version of the earlier P.S.6, but took so long to enter production it was obsolete when it entered service. The main source used here is Davilla and Soltan [71, pp 454–456]. Engines known to be used are: 250 hp Renault. Performance figures are given in table 28.

Table 25: Nieuport 24 and 24bis performance figures. The main sources are JM Bruce [59, pp 334–336] and Davilla and Soltan [71, p 398]. Wing span: 8.25 m; wing area: 14.75 m².

Aircraft	N.24	N.24bis
Weights (kg):		
Empty	355	
Loaded	547	
Max speed (kph):		
Sea level	176	170
2000 m	171	170
3000 m	169	
3150 m		167.7
4000 m	163	
Climb to (min):		
1000 m	2 40	2 40
2000 m	5 40	5 40
3000 m	9 25	9 40
4000 m	15 00	
5000 m	21 30	21 40
Service Ceiling (m)	6900	
Endurance (hrs)	2.25	

Table 26: Nieuport 27 performance figures. The main sources are JM Bruce [59, p 338] and Davilla and Soltan [71, p 404]. Wing span: 8.21 m; wing area: 14.75 m².

Aircraft	N.27
Weights (kg):	
Empty	380
Loaded	535
Max speed (kph):	
Sea level	172
2000 m	170
3000 m	167
4000 m	165.7
Climb to (min):	
2000 m	5 40
3000 m	9 25
4000 m	14 40
5000 m	21 30
Service Ceiling (m)	6850
Endurance (hrs)	2.25

Table 27: Nieuport 28 performance figures. The main sources are Peter M Bowers [12] and Davilla and Soltan [71, p 408]. Wing span 26 ft 3 in; wing area 215 ft²; wing loading 7.6 lb/ft².

Aircraft			2nd Prototype
Date			14 Oct 1917
Engine	165 hp	160 hp	165 hp
	Gnome 9N	Gnome 9Nc	Gnome 9N
Weights (lb):			
Empty	1172	456 kg	
Loaded	1625	698 kg	
Wing loading (lb/ft ²)			
	7.6		
Max speed (mph):			
	122		
Landing speed (mph):			
	53.7		
Max speed (kph)			
2000 m		198	198
3000 m			194
4000 m			189
5000 m			179
Climb to (min):			
5000 ft	4.5		
10000 ft	11.5		
1000 m			2 25
2000 m		5.5	5 15
3000 m			8 55
4000 m			13 25
5000 m			20 20
Service Ceiling (ft)			
	17000	5180 m	6800 m
Endurance (hrs)			
	1.5	1 30	

Table 28: Paul Schmitt 7 performance figures. The main source is Davilla and Soltan [71, p 454]. Wing span: 17.50 m; wing area: 48.40 m². Bomb load: 150 kg.

Engine	250 hp
	Renault
Weights (kg):	
Empty	1298
Loaded	2098
Max speed (kph):	
2000 m	135
3000 m	131
4000 m	121
Climb to (min):	
2000 m	21.45
3000 m	36.5
Service Ceiling (m)	
	4000
Endurance (hrs)	
	5

3.21 Salmson 2A.2

The Salmson 2A.2 was a major Aviation Militaire and USAS two-seat reconnaissance aircraft in 1918. The main source used here is Davilla and Soltan [71, pp 439–446]. For photo-reconnaissance the Salmson 2A.2 could use the 26 cm, ‘Grand Champ’ 50 cm and 120 cm cameras; all had multi-plate magazines and semi-automatic plate changers [76, pp 291–292]. An installation of the ‘de Ram’ camera inside the fuselage is shown by Finnegan [76, p 291]. Engines known to be used are: 230 hp Salmson 9Za. Performance figures are given in table 29.

- Harold Porter [127, p 336] considers the Salmsons and Breguets the USAS obtained from the French to be ‘first-rate ships’.

Table 29: Salmson 2A.2 performance figures. The main source is Davilla and Soltan [71, p 443]. Wing span: 11.750 m; wing area: 37.270 m². For ground attack purposes the Salmson 2A.2 could carry 230 kg of bombs.

Engine	230 hp Salmson 9Za
Weights (kg):	
Empty	780
Loaded	1290
Max speed (kph):	
Sea level	188
2000 m	186
3000 m	181
4000 m	173
5000 m	168
Climb to (min):	
1000 m	3 18
2000 m	7 13
3000 m	17 20
4000 m	27 30
Service Ceiling (m)	6250
Endurance (hrs)	

3.22 Spad SA.1–SA.4

The Spad SA.1, SA.2, SA.3 and SA.4 were Aviation Militaire two-seat fighters in 1915–16. They had the unusual property of the engine and propeller being mounted between the pilot (rear cockpit) and the gunner (front cockpit). Russia somewhere over fifty of these aircraft. Engines known to be used include 80 hp Le Rhône 9C; 110 hp Le Rhône 9J. The main source used here is Davilla and Soltan [71, pp 474–478]. Performance figures are given in table 30.

Table 30: Spad SA.1–SA.4 performance figures. The main source is Davilla and Soltan [71, p 478]. Wing span 9.55 m; wing area 25.36 m².

Aircraft	SA.1	SA.2	SA.2
Engine	80 hp Le Rhône 9C	110 hp Le Rhône 9J	80 hp Le Rhône 9C
Weights (kg):			
Empty	421	414	535
Loaded	708	674	815
Max speed (kph):			
sea level	135	140	112
Climb to (min):			
1000 m		6 30	8 00
2000 m	12 30	20 00	
3000 m		23 30	
Service Ceiling (m)		4000	3000
Endurance (hrs)	2.75	3	2

3.23 Spad VII

The Spad VII was a major Aviation Militaire fighter in 1916–1918 and was also widely by the RFC. Engines known to be used include: 150 hp Hispano-Suiza 8Aa, 180 hp Hispano-Suiza 8Ab, 150 hp Wolseley W.4A Python I and 180 hp Wolseley W.4A Python II. The main sources used here are JM Bruce [59, pp 553–558] who focuses on British service, and Davilla and Soltan [71, pp 485–494]. Performance figures are given in table 31.

- JM Bruce [59, p 556] comments that it was found that the British made Spads had a poorer performance than French made Spads and were nose-heavy in flight.
- Oliver Stewart [15, pp 94–96] says the Spad was easy to fly and possessed excellent powers of manoeuvre, greater than those of the S.E.5a; also that 19 Squadron RFC devised a container by which their Spads could carry 2 × 25 lb Cooper bombs.
- René Fonck [79, p 130] states his Spad VII with a 180 hp engine would reach 180 kmh.
- Edward Sims cites Joseph Jacobs [135, pp 56–57] as stating that flying against the Spad he found that it ‘wasn’t so good for manoeuvrability, but had good speed, could climb rapidly and was stable’.
- Henry Bordeaux [10, p 70] says the Spad had poor visibility to the sides. Henry Bordeaux [10, p 92] says the Spad was superior in strength, speed and ease of control to the Albatros. Henry Bordeaux [10, p 117] cites Georges Guynemer as considering the 150 hp Spad was faster than the Halberstadt, but climbed more slowly.
- EM Roberts [129, pp 251–255] says he was on a patrol at 20,000 ft and later engaged an Albatros at 18,000 ft.
- J E Tennant [141, p 156] states the in summer in Mesopotamia the standard Spad overheated very quickly, starting to boil as he left the ground, and it was a very hot machine to fly. Changes to the cooling system were presumably made to overcome these problems as with other water-cooled aircraft.
- Georges Thenault [142, p 73] gives the top speed as 125 mph. Georges Thenault [142, p 102] says ‘the Spad was inimitable’ when comparing with the Albatros D.III and D.V, implying a considerable level of superiority. Georges Thenault [142, p 117] says the Spad was superior in every way to the Sopwith Triplane in stunting. Georges Thenault [142, pp 123–128] says the Spad could dive at 250 mph, dive without fear of consequence (wings collapsing) and a single-seat Spad could take photographs using an automatic apparatus.
- Henry Farré [75, p 137] states that the Spad was very superior in design to all other fighting planes. However, some pilots still preferred the Nieuport as they found it more handy. Henry Farré [75, pp 146–9] cites a story by de la Tour involving an early fight between Spad and Albatros in which the two aircraft are described as about equal, the Spad being faster (note: the story is said to have occurred in May 1916, but that is prior to the introduction to service of both Spad VII and Albatros D.I).

3.24 Spad XI

The Spad XI was an Aviation Militaire two-seat fighter in 1917–1918. There were some Spad XI used by Belgium and the USAS. Engines known to be used include: 220 hp Hispano-Suiza 8Ee, 220 hp Hispano-Suiza 8Bc. The main source used here is Davilla and Soltan [71, pp 494–499]. Performance figures are given in table 32.

3.25 Spad XII

The Spad XII was a Aviation Militaire fighter used on a small scale in 1917–18, it was mainly flown by significant French aces. The major feature was the use of the 37 mm Hotchkiss shell-firing gun firing through a hollow airscrew shaft with the geared engine. Engines known to be used include: 200 hp Hispano-Suiza 8C; 220 hp Hispano-Suiza 8Cb. The main sources used here are JM Bruce [59, pp 559–560] and Davilla and Soltan [71, pp 500–501]. Performance figures are given in table 33.

- René Fonck [79, p 131] states his Spad XII with a 230 hp engine would reach 230 kmh.

3.26 Spad XIII

The Spad XIII was a major Aviation Militaire fighter in 1917–18, some use by Belgium and Italy, there was small scale use by the RFC and it was a major fighter for the USAS. The main sources used here CF Andrews [3], Davilla and Soltan [71, pp 501–510], some information is taken from JM Bruce [59, pp 561–564]. Engines known to be used include: 200 hp Hispano-Suiza 8Ba, 8Bb and 8Bd; 220 hp Hispano-Suiza 8BA, 8Bc and 8Be (1917); and 235 hp Hispano-Suiza 8BEc (1918). Performance figures are given in table 34.

- JM Bruce [59, pp 477 and 561] comments that the Spad was plagued by similar problems with the geared Hispano-Suiza to those that affected the S.E.5a program. In November 1917 it was reported that the 200 hp Spad aircraft in the Aviation Militaire were grounded on two days out of three because their Hispano-Suiza engines were unserviceable.

Table 31: Spad VII performance figures. The main sources are JM Bruce [59, pp 553–558] and Davilla and Soltan [71, p 493]. Wing span 7.822 m; wing area 17.85 m². For ground attack RFC Spad VII could carry up to 2 × 25 lb Cooper bombs. French Spad VII’s could carry 2 × 10 kg Anilite bombs.

Test Date	Engine	150 hp HS 8Aa	180 hp HS 8Ab	M.96 Apr 17 150 hp HS	M.96B May 17 150 hp HS Wolseley
Weights (kg):					
Empty	1102 lb	500	500	1177 lb	
Military Load				80 lb	96 lb
Pilot				180 lb	180 lb
Fuel and Oil				195 lb	
Loaded	1554 lb	705	705	1652 lb	
Max speed (kph):					
sea level		193			
2000 m		187	212		
6500 ft				119 mph	
3000 m		180	204		
10000 ft				115.5 mph	112 mph
4000 m		174	200		
15000 ft				107.5 mph	104 mph
5000 m			187		
Climb to (min)/ Rate (ft/s):					
2000 m		6 40	4 40		
6500 ft				6 18 / 810	7 06 / 725
3000 m		11 20	8 10		
10000 ft				11 18 / 570	12 48 / 510
4000 m			12 49		
15000 ft				24 30 / 240	27 18 / 220
Service Ceiling (m)		5500	6553	17500 ft	17500 ft
Endurance (hrs)		2.66	1.5	2.5	

Table 32: Spad XI performance figures. The main source is Davilla and Soltan [71, p 495 and 499]. Wing span 11.24 m; wing area 30 m². Bomb load: 70 kg.

Aircraft	SPA 6049
Engine	220 hp HS 8Ee HS 8Bc
Weights (kg):	
Empty	679
Loaded	1167.5
Date	25 Oct 17
Max speed (kph):	
Sea level	185
2000 m	181
3000 m	177
4000 m	168
Climb to (min):	
500 m	1 35
1000 m	3 25
2000 m	7 35
3000 m	12 30
4000 m	17 30
Service Ceiling (m)	6300
Endurance (hrs)	2.25

Table 33: Spad XII performance figures. The main sources are JM Bruce [59, p 560] and Davilla and Soltan [71, p 500]. Wing span 8.00 m; wing area 20.2 m².

Aircraft	
Engine	220 hp 8Cb
Weights (kg):	
Empty	587
Loaded	883
Max speed (kph):	
2000 m	203
3000 m	198
4000 m	190
5000 m	177
Climb to (min):	
2000 m	6 03
3000 m	10 02
4000 m	15 42
5000 m	23 13
Service Ceiling (m)	6850
Endurance (hrs)	1.75

- JH Morrow [123, pp 290–1] states that Caquot of the STAé found the geared Hispano-Suiza problem to be due to the viscosity of the oil supply to the gears being higher in winter causing excessive pressure. The solution was to install a simple, inexpensive safety valve for the end of the oil pump to decrease the pressure in the oil pipe.
- CF Andrews [3, p 6] states that the Spad XIII had a high-lift wing section which was one factor in the better climb over the S.E.5a with the same engine. The S.E.5a is said to have a high-speed wing section and have better manoeuvrability. However, the speeds were not dissimilar with the same engine and anecdotes suggest the Spad was more manoeuvrable, see section 7.26.
- Edward Rickenbacker [128, p 210] states that the Spad XIII was much stronger and could out-dive their previous Nieuport 28 allowing the pilots the confidence to manoeuvre their aircraft. Edward Rickenbacker [128, p 224] states that the Spad XIII climbed faster than the Fokker; this was before the St Mihiel offensive and would be 220 hp Hispano-Suiza powered Spad XIII versus Mercedes powered Fokker DVII. Edward Rickenbacker [128, p 310 and 313] states that ‘no Fokker can overtake a Spad unless he has sufficient advantage in elevation’ and that the Siemens Schuckert, presumably either DIII or DIV had a much faster climb than the Spad.
- René Fonck [79, p 81] reports his Spad XIII flying at 6,200 m during an attack on German planes. René Fonck [79, p 99] reports a dive during an attack at a speed of at least 240 kmh. René Fonck [79, p 116] states that ‘the new Fokkers were more manoeuvrable than our Spads’. René Fonck [79, p 124] states that the Spad XIII sometimes reached a speed of 300 kmh, presumably in diving attacks. René Fonck [79, p 130–131] states his 220 hp Spad XIII reached 210 kmh, while another 220 hp Spad XIII reached 235 kmh.

3.27 Spad XVI

The Spad XVI was an Aviation Militaire two-seat fighter in 1917–1918. It was an improved Spad XI. Engines known to be used include: 240 hp Lorraine 8Bb. The main source used here is Davilla and Soltan [71, pp 515–519]. Performance figures are given in table 35.

3.28 Spad XVII

The Spad XVII was a minor Aviation Militaire fighter in 1918. The aircraft is described as essentially a Spad XIII modified and strengthened to take the 300 hp Hispano-Suiza. Twenty aircraft were produced and were assigned to GC 12. The main source used here is Davilla and Soltan [71, pp 521–522]. Engines known to be used include: 300 hp Hispano-Suiza 8Fb. Performance figures are given in table 36.

3.29 Voisin 3 (LA and LA.S)

The Voisin 3 (also known as Voisin LA) and LA.S were French two-seat pusher reconnaissance-bomber aircraft used by the Aviation Militaire mainly in 1915–16. Early uses were as a fighter and ground attack aircraft. The

Table 34: Spad XIII performance figures. The main sources are CF Andrews [3], Davilla and Soltan [71, p 509] and JM Bruce [59, p 564]. The main report used by Andrews is Report No. 5, Aéronautique Militaire, Ministre de la Guerre, 1917. The Profile also notes that with 235 hp 8BEc the highest speed was 138 mph. The second set of figures is for a USAS Spad XIII with Wright-Hispano and all-up-weight of 2036 lb. The fourth column is from JM Bruce [59, p 564]. The fifth and sixth columns are from Davilla and Soltan [71, p 509]. Power loading 8.2 lb/hp; Wing span 8.25 m (early) or 8.08 m (later) (26 ft 4 in); Wing area 21.11 m² (early) (227 ft²) or 20.2 m²; Wing loading 8 lb/ft². Bomb load: 4 × 25 lb Cooper bombs could be carried by the USAS for ground attack.

Report Date Aircraft Engine	No. 5 1917	USAS			
	220 hp HS 8BA	220 hp HS Wright-Hispano	220 hp HS 8Ba, 8Bb or 8Bd	200 hp HS 8Bc or 8Be	220 hp
Weights (lb):					
Empty	1245				601.5 kg
Military Load	320				
Fuel, oil and water	242				
Loaded	1807	2036			856.5
Power loading (lb/hp)	8.2				
Wing loading (lb/ft ²)	8				
Max speed (kph):					
Ground Level		131.5 mph			
1000 m				211	
6500 ft		128.0 mph			
2000 m	215		218	208.5	218
3000 m	214		214	205.5	
4000 m	209			201	
5000 m	203		203	190	
Climb to (min):					
500 m	0.55				
1000 m	1.55			2 20	
6500 ft		6.5			
2000 m	4.40		4 40	5 17	4.67
3000 m	7.50		7 50	8 45	
4000 m	12.10			13 05	
5000 m	18.30		18 30	20 10	
Service Ceiling (m)			6850	6800	6800
Endurance (hrs)	2		1 40	2	1.67

Table 35: Spad XVI performance figures. The main source is Davilla and Soltan [71, p 519]. Wing span 11.21 m; wing area 30 m². Bomb load: 70 kg.

Aircraft	
Engine	240 hp Lorraine 8Bb
Weights (kg):	
Empty	
Loaded	1140
Max speed (kph):	
Sea level	179.8
1000 m	178
2000 m	175
3000 m	169
Climb to (min):	
1000 m	4 28
2000 m	9 15
3000 m	15 51
4000 m	29 27
Service Ceiling (m)	
Endurance (hrs)	

Table 36: Spad XVII performance figures. The main source is Davilla and Soltan [71, p 521]. Wing span 8.08 m; 20 m².

Aircraft	
Engine	300 hp HS 8Fb
Weights (kg):	
Empty	675
Loaded	942
Max speed (kph):	
2000 m	217
3000 m	214
4000 m	211
5000 m	201
Climb to (min):	
2000 m	5 24
3000 m	8 20
4000 m	12 32
5000 m	17 21
Service Ceiling (m)	7175
Endurance (hrs)	1.25

RFC/RNAS made some use of these models, mainly in the Middle-East. The aircraft were later mainly used as bombers and even later as night bombers. The Voisin brothers were notable for their use of steel as a structural material. The engines known to have been used include: 120 hp Salmson M.9; 130 hp Salmson M.9 (LA); 140 hp Salmson B.9 (LA.S); Salmson P9; and Salmson R9. The main sources used here are [59, pp 606–610] and Davilla and Soltan [71, pp 544–550]. Performance figures are given in table 37.

- Richard Bell Davies [7, p 122] reports favourably on what may have been this model of Voisin but with an Canton-Unné engine when used at Gallipoli. They were ‘rather slow’ and the engine had to be run ‘full out’ to climb, but they ‘proved most useful’.

Table 37: Voisin 3 (LA and LA.S) performance figures. The main sources are JM Bruce [59, pp 606–610] and Davilla and Soltan [71, pp 544–550]. Bomb load: up to 200 lb (91 kg British figures); 150 kg (French figures). Wing span: 14.74 m; wing area 49.64 m².

Aircraft	LA	LA	LA.S	LA.S
Engine	120 hp	120 hp	120 hp	120 hp
	Salmson M9	Salmson M9	Salmson M9	Salmson M9
Weights (kg):				
Empty	950	950	950	994
Loaded	1350	1350	1350	1400
Max speed (kph):				
Sea level	105		110	
2000 m		98		100
Climb to (min):				
1000 m	12 00		10 00	
2000 m	30 00	24 30	24 30	24 00
Service Ceiling (m)				
Endurance (hrs)	4.5		4	

3.30 Voisin 5 and 6 (LAS)

The Voisin 5 and 6 (known to the factory as Voisin LAS) was a French two-seat pusher reconnaissance-bomber aircraft used by the Aviation Militaire mainly in 1915–16. The aircraft was a modified Voisin 3 with a more powerful engine, strengthened airframe and streamlined nacelle. The Voisin 6 had an even more powerful engine. The Voisin brothers were notable for their use of steel as a structural material. The engines known to have been used include: 150 hp Salmson P9 (Voisin 5); 155 hp Salmson R9 (LA). The main source used here is Davilla and Soltan [71, pp 552–556]. Performance figures are given in table 38.

Table 38: Voisin 5 (LAS) performance figures. The main source is Davilla and Soltan [71, pp 552–556]. Bomb load: up to 180 kg. Wing span: 14.74 m; wing area 45 m².

Aircraft	LB	LBS
Engine	150 hp	160 hp
	Salmson P9	Salmson
Weights (kg):		
Empty	1000	975
Loaded	1450	1325
Max speed (kph):		
2000 m	109	105
Climb to (min):		
2000 m	22 00	22 00
3000 m		40 00
Service Ceiling (m)		
		3500
Endurance (hrs)	4	4

3.31 Voisin 8 BN2 (LAP) and Ca2 (LBP)

The Voisin 8 (known to the factory as Voisin LAP) was a French two-seat pusher reconnaissance-bomber aircraft used by the Aviation Militaire mainly in 1916–17. The Voisin Ca2 (known to the factory as Voisin LBP) was a French two-seat cannon armed aircraft version of the LAP. The aircraft was improved over the earlier types with a more powerful engine, enlarged and strengthened airframe and streamlined nacelle. The aircraft had the usual Voisin steel airframe and the fuselage was covered by aluminium sheet. The engines known to have been used include: 220 hp Peugeot 8Aa. The main source used here is Davilla and Soltan [71, pp 559–561]. Performance figures are given in table 39.

Table 39: Voisin 8 (LAP) and Ca2 (LBP) performance figures. The main source is Davilla and Soltan [71, pp 559–561]. Bomb load: about 180 kg. Wing span: 18 m; wing area 61.14 m².

Aircraft	LAP	LBP
Engine	220 hp Peugot 8Aa	220 hp Peugot 8Aa
Weights (kg):		
Empty	1310	1310
Loaded	1860	1860
Max speed (kph):		
2000 m	118	118
Climb to (min):		
2000 m	17 00	17 00
Service Ceiling (m)		
Endurance (hrs)		

3.32 Voisin 10 (LAR) and Ca2 (LBR)

The Voisin 10 (known to the factory as Voisin LAR) was a French two-seat pusher reconnaissance-bomber aircraft used by the Aviation Militaire mainly in 1917–18. The Voisin Ca2 (known to the factory as Voisin LBP) was a French two-seat cannon armed version of the same aircraft. The aircraft was improved over the Voisin 8 with a more powerful engine. The aircraft had the usual Voisin steel airframe and the fuselage was covered by aluminium sheet. The engines known to have been used include: 280 hp Renault 12Fe. The main source used here is Davilla and Soltan [71, pp 563–566]. Performance figures are given in table 40.

Table 40: Voisin 10 (LAR) and Ca2 (LBR) performance figures. The main source is Davilla and Soltan [71, p 565]. Bomb load: 300 kg. Wing span: 17.90 m; wing area 61.14 m².

Aircraft	LAR	LBR
Engine	280 hp Renault 12Fe	280 hp Renault 12Fe
Weights (kg):		
Empty	1400	1450
Loaded	2200	2200
Max speed (kph):		
2000 m	135	130
Climb to (min):		
2000 m	20 00	14 40
Service Ceiling (m)		
Endurance (hrs)		
	5	5

4 Germany

Useful information on German testing can be obtained from Wilhelm Hoff [103] naca-tn-56.pdf and Heidelberg and Hölzel [98] naca-tn-147.pdf. Some extracts are: ‘The flying properties, namely, the manoeuvrability and

control of the plane at various altitudes and in various positions, was judged almost entirely by specially experienced pilots.’, ‘Speed was not measured regularly. To accomplish the latter steady, horizontal flights are a requisite, and even trained pilots cannot always accomplish this accurately.’ and ‘For measuring speed, either static measuring apparatus or wind gauges were used, in the aeroplanes.’. These indicate some of the limitations of the techniques available at the time.

According to Hooton [104, p 86] the Germans used bombs of 50 kg and 100 kg by 1916. They introduced 300 kg bombs in 1917 on the Western Front, while the Giants occasionally dropped up to 1 tonne bombs in 1918.

4.1 A.E.G. C IV

The A.E.G. C IV was a two-seat reconnaissance or artillery observation aircraft for the Luftstreitkräfte in 1917–18. The main reference used is Gray and Thetford [80, pp 3–5]. Engines known to have been used include: 160 hp Mercedes D III. Performance figures are given in table 41.

Table 41: A.E.G. C IV performance figures. The main source is Gray and Thetford [80, pp 3–5]. Wing span: 13.46 m; wing area: 39 m².

Engine	160 hp Mercedes
Weights (kg):	
Empty	800
Loaded	1120
Max speed (kph):	158
Climb to (min):	
1000 m	6
Service Ceiling (m)	5000
Endurance (hrs)	4

4.2 A.E.G. G types

The A.E.G. G IV was a three or four-seat (normally three) specialised reconnaissance or bomber aircraft for the Luftstreitkräfte in 1917–18. Only one G I was made, the G II was made in small numbers and limited numbers of the G III. The G IV was made in considerable numbers. The main reference used is Gray and Thetford [80, pp 6–8] for G IV and [80, pp 241–2] for G I, II and III. Engines known to have been used include: 2 × 100 hp Mercedes D I; 2 × 150 hp Benz Bz III; 2 × 220 hp Mercedes D IV; and 2 × 260 hp Mercedes D IVa (G IV). Performance figures are given in table 41.

Table 42: A.E.G. G I, II, III and IV performance figures. The main source is Gray and Thetford [80, pp 6–8] and [80, pp 241–2]. Bomb load: 200 kg externally (GII); 300 kg (G III); 880 lb total comprising multiple 25 lb (10 kg) bombs and one 50 kg bomb (G IV). Wing span: 18.40 m; wing area: 67 m².

Aircraft	G I	G II	G III	G IV
Engine	2 × 100 hp Mercedes	2 × 150 hp Benz	2 × 220 hp Mercedes	2 × 260 hp Mercedes
Weights (kg):				
Empty	1160	1450	1940	2400
Loaded	1954	2470	3015	3630
Max speed (kph):	125	140	158	165
Climb to (min):				
800 m	10–12			
1000 m		11	6	5
Service Ceiling (m)				4500
Endurance (hrs)				3.5 (full power)
Endurance (hrs)				4–5 (cruise)

4.3 A.E.G. J I and II

The A.E.G. J I and II were two-seat armoured Infantry Contact Patrol aircraft for the Infanterie-Flieger units of the Luftstreitkräfte in 1917. The armour weighed 860 lb in the form of 5.1 mm thick plate from the nose to the aft extremity of the rear cockpit. These machines were replaced by specially designed machines such as the Junkers J I. The main reference used is Gray and Thetford [80, pp 9–12]. Engines known to have been used include: 200 hp Mercedes D III. Performance figures are given in table 43.

Table 43: A.E.G. J I and II performance figures. The main source is Gray and Thetford [80, pp 3–5]. It is not clear whether the performance figures pertain to the J I or J II or both. Wing span: 13.460 m; wing area: 33.18 m².

Aircraft	J I	J II
Weights (kg):		
Empty	1455	1480
Loaded	1740	1765
Max speed (kph):		
	150	
Climb to (min):		
1000 m	6	
Service Ceiling (m)		
	4500	
Endurance (hrs)		
	2.5	

4.4 Ago C I and C II

The Ago C I and C II were twin-boom pusher two-seat aircraft used in small numbers in 1915 for reconnaissance. The C I, at least, is said to have been ‘often seen’ on the Western Front. Performance figures are given in table 44.

- Either the C I or C II are the probable identity of the ‘Two-Tails’ described by Duncan Grinnell-Milne [86, pp 91–95] around Autumn 1915 which was said to be fast and with a much better climb than the B.E.2.
- ‘Two-Tails’ is also mentioned by AJ Insall [106, pp 108–9].

Table 44: Ago C I and C II performance figures. The main source is Gray and Thetford [80, pp 247–248]. Wing span: (C I) 14.5 m; C II 14.5 m.

Aircraft	C I	C II
Weights (kg):		
Empty	800	1360
Loaded	1320	1946
Max speed (kph):		
	145	137
Climb to (min):		
1000 m	7–10	
Service Ceiling (m)		
Endurance (hrs)		
	4	

4.5 Ago C IV

The Ago C IV was a two-seat reconnaissance aircraft used in small numbers by the Luftstreitkräfte in 1917–18. Engines known to have been used include: 220 hp Benz Bz IV. Performance figures are given in table 45.

- Hans Schröder [134, p 92] states that in January 1917 Flying Section 248A had been expecting Rumpler aircraft, but instead received Ago aircraft with very pointed wings. They were found to ‘be most unstable in the air. Their climbing capacity was not particularly great, and we were very disappointed with them’. The descriptions fits the Ago C IV.

4.6 Albatros B II

The Albatros B II was a two-seat reconnaissance or training machine for the Luftstreitkräfte in 1914–15. The B IIa was a later version used almost exclusively for training. The main reference used is Gray and Thetford [80, pp 17–19]. Engines known to have been used include: 100 hp Mercedes D I (B II and IIa); 120 hp

Table 45: Ago C IV performance figures. The main source is Gray and Thetford [80, pp 13–16]. Wing span: 11.90 m; wing area: 37.5 m².

Weights (kg):	
Empty	900
Loaded	1350
Max speed (kph):	190
Climb to (min):	
3000 m	22
Service Ceiling (m)	5500
Endurance (hrs)	4

Mercedes D II (B II and IIa); 100 hp Benz Bz II (B II); or 120 hp Argus As II (B IIa). Performance figures are given in table 46.

- Hans Schröder [134, pp 60–1] describes around August 1916 Flying Section 58 having a ‘new’ Albatros with a 120 hp Mercedes that could climb to 3000 m in 17 min and armed with a forward gun that fired through the propeller. This is most likely an Albatros B II, although a forward firing gun implies the pilot and observer had been swapped. For C-types which had forward firing guns the engines were usually more powerful.

Table 46: Albatros B II performance figures. The main source is Gray and Thetford [80, pp 17–19]. Wing span: 12.80 m (B II), 12.96 m (B IIa); wing area: 40.12 m² (B II), 40.64 m².

Aircraft	B II	B IIa
Weights (kg):		
Empty	723	698
Loaded	1071	1078
Max speed (kph):	105	120
Climb to (min):		
800 m	10	8.2
Service Ceiling (m)	3000	
Endurance (hrs)	4	

4.7 Albatros C types

The Albatros C types were a two-seat general purpose aircraft (C I, IIa, III, V), artillery cooperation and bomber (C V, VII, X) and reconnaissance (C VII, X) for the Luftstreitkräfte in 1915–18. The main reference used is Gray and Thetford [80, pp 20–23] (C I), [80, pp 24–26] (C III), [80, pp 27–30] (C V), [80, pp 31–33] (C VII), [80, pp 34–35] (C X) and [80, pp 36–38] (C XII). Engines known to have been used include: 150 hp Benz Bz III (C I, C III); 160 hp Mercedes D III (C I and IIa, C III); 180 hp Argus As III (C I); 220 hp Mercedes D IV (C V); 200 hp Benz Bz IV (C VII); 260 hp Mercedes D IVa (C X, XII). Performance figures are given in table 47.

- Carl Degelow [110, pp 51–52] says that, around March 1917 while in Flieger-Abteilung (A) 216, his Albatros C.V was slower than the other aircraft in a group of three. The aircraft were employed for photographic work and artillery observation.

4.8 Albatros DI–DIII

The Albatros DI through DIII were major Luftstreitkräfte fighters in 1916–17. The main sources used are Peter Gray [84] and Gray and Thetford [80, pp 39–48]. The engines known to have been used are the 150 hp Benz Bz III; 160 hp Mercedes D III; 175/185 hp Mercedes D IIIa (a higher compression version of the D III); 185/225 hp Austro Daimler (Austrian Oeffag built aircraft only). Performance figures are given in table 48.

- Sir Gordon Taylor [140, pp 116–117] states that a captured Albatros he flew on 18th June 1917 climbed to 3000 ft in a few seconds over 3 minutes, to 6000 ft in 7 minutes. The maximum indicated level air speed speed was about 125 mph at 3000 ft. From the photograph this was a DII (parallel interplane struts, out-splayed centre-section struts), British serial ‘G42’.

Table 47: Albatros C I, III, V, VII, X and XI performance figures. The main source is Gray and Thetford [80, pp 20–38]. Bomb load mostly described as light: unknown (C I); 200 lb (C III); unknown (C V); unknown (C VII); unknown (C X); unknown (C XII).

Aircraft	C I	C III	C V	C VII	C X	C XI
Weights (kg):						
Empty	875	851	1024	989	1050	1021
Loaded	1190	1353	1585	1550	1668	1639
Max speed (kph):						
	132–140	140	170	170	175	175
Climb to (min):						
1000 m	9.75	9	8	8	5	5
2000 m					11	
5000 m					55	
Service Ceiling (m)						
	3000	11000 ft		5000	5000	5000
Endurance (hrs)						
	2.5	4	3.25	3 20	3 25	3.25

- Julius Bucker [61, pp 124–126] describes a combat in which the engine of his Albatros reached 2000 rpm, this was probably July 1917 and presumably was a D.III.
- CPO Bartlett [6, p 60] (20th June 1917) reports on a comparison of a captured Albatros D.III with a Sopwith Camel and a Sopwith Triplane. He reports the Albatros was outclassed in speed and climb, but manoeuvred well.
- Edward Sims [135, pp 80–81] cites Theo Osterkamp as saying the Albatros D.III and D.IV (surely D.V) were not very manoeuvrable and the Spad was faster.
- Gwilym Lewis [116, p 78] on 23rd October 1916 says the German ‘new single-seaters very good’ and ‘can fly rings round and round’ when comparing with the D.H.2.

Table 48: Albatros DI–DIII performance figures. The main sources used are Peter Gray [84] and Gray and Thetford [80, pp 39–48]. The final column is taken from Gray and Thetford. Wing span DI/DII: 8.5 m; DIII: 9.05 m; wing area DI: 22.9 m², DII: 24.5 m², DIII 20.5 m².

Aircraft Engine	DI	DII	DIII	DIII
Weights (kg):				
Empty	647	637	661	661
Loaded	898	888	886	886
Max speed (kph):				
	175	175	165	165
Climb to (min):				
1000 m	6	5	3.3	4
2000 m		9.1	7.2	
3000 m		15.4	12.1	
4000 m		26	18.8	
Service Ceiling (ft)				
	17000			18000
Endurance (hrs)				
	1.5	1.5	2	2

4.9 Albatros DV

The Albatros DV and DVa were major Luftstreitkräfte fighters in 1917–18. The main sources used are Peter Gray [81] and Gray and Thetford [80, pp 49–52]. The DV and DVa had an unfortunate tendency to break up in a prolonged dive. The engines known to have been used are the 160 hp Mercedes D III; 170/185 hp and 200 hp Mercedes D IIIa (a higher compression version of the D III, oversized pistons in the 200 hp version). Performance figures are given in table 49.

- Comments on a modern reproduction ‘In flight the D.Va performs well, not nearly as well balanced and harmonised as the RAF S.E.5a though. The ailerons are heavy and the roll rate isn’t very spectacular, the elevator is very sensitive, almost too sensitive while the rudder is less than adequate’.

- Ernst Udet states [144, pp 44–45] that the Spad VII with 180 hp engines were very fast, handy and far superior to the Albatros, especially when it came to diving. The wings of the Albatros showed visible and alarming signs of not being able to stand the strain of a very steep dive.
- James McCudden [119, p 215] states he flew a captured Albatros V-strutter on 5th November 1917, this was presumably a D.V. He could not think how the German pilots could manoeuvre them so well as they were not easy to handle.

Table 49: Albatros DV/DVa performance figures. The main sources used are Peter Gray [81] and Gray and Thetford [80, pp 49–52]. D7117/17 has two times for the climb to 6000 m, 24.5 min and 23.5 min. The final set of figures are from Gray and Thetford, the weight figures indicate this is a DVa. Wing span 9.05 m; Wing area 21.2 m².

Aircraft Engine	DV Mercedes D III 160 hp	DVa	D7117/17 BMW IIIa 185 hp	DVa
Weights (kg):				
Empty	620	687		687
Loaded	852	937	872.8	937
Max speed (kph):				
	165			186
Climb to (min):				
1000 m	4.0			4
2000 m	8.8			
3000 m	14.8			
4000 m	22.8			
5000 m	35.0			
6000 m			23.5	
Service Ceiling (m)				
				5700
Endurance (hrs)				
				2

4.10 Albatros W4

The Albatros W4 was a German Naval float-plane fighter in 1916–17. It was related to the Albatros DII. The main source used is Gray and Thetford [80, pp 56–58]. The engines known to have been used are: 160 hp Mercedes D III. Performance figures are given in table 50.

Table 50: Albatros W4 performance figures. The main source used is Gray and Thetford [80, pp 58]. Wing span 9.5 m; Wing area 31.6 m².

Aircraft Engine	W4 Mercedes D III 160 hp
Weights (kg):	
Empty	790
Loaded	1070
Max speed (kph):	
	158–169
Climb to (min):	
1000 m	5.0
Service Ceiling (m)	
	3000
Endurance (hrs)	
	3

4.11 Aviatik C I and C III

The Aviatik C I and C III were a major Luftstreitkräfte two-seat reconnaissance and escort aircraft in 1915–16. The main source used is Gray and Thetford [80, pp 61–63]. The engines known to have been used are the 160 hp Mercedes D III. Performance figures are given in table 51.

Table 51: Aviatik C I and C III performance figures. The main source used is Gray and Thetford [80, pp 61–63].

Aircraft	C I	C III
Weights (kg):		
Empty	750	980
Loaded	1242	1340
Max speed (kph):		
	142	160
Climb to (min):		
1000 m	12	7
4500 m		55
Service Ceiling (m)		
	3500	4500
Endurance (hrs)		
	3	

4.12 Brandenburg floatplanes

The Brandenburg K.D.W., W12, W19 and W29 were German Naval float-plane fighters in 1916–17. The main source used is Gray and Thetford [80, pp 64–78]. The engines known to have been used are: 150 hp Benz Bz III (K.D.W., W12, W29); 160 hp Maybach Mb III (K.D.W., W12); 260 hp Maybach Mb IV (W19); 185 hp Benz Bz IIa (W29). Performance figures are given in table 52.

Table 52: Brandenburg K.D.W., W12, W19 and W29 floatplane performance figures. The main source used is Gray and Thetford [80, pp 64–78]. Wing span 9.25 m (K.D.W.), 11.2 m (W12), 13.80 m (W19), 13.5 m (W29); Wing area: 20 m² (K.D.W.), 35.3 m² (W12), 57.8 m² (W19), 32.2 m² (W29).

Aircraft	K.D.W.	W12	W19	W29
Weights (kg):				
Empty	940	997	1435	1000
Loaded	1210	1454	2005	1494
Max speed (kph):				
	170	159.5	150.5	175
Climb to (min):				
1000 m	5.9	7	6.4	6
2000 m	14	18.9	18.9	13
3000 m	21		23.0	23
Service Ceiling (m)				
		16000 ft		16400 ft
Endurance (hrs)				
	2.5	3.5	5	4

4.13 D.F.W. C V

The D.F.W. C V was a major Luftstreitkräfte two-seat reconnaissance, artillery co-operation and infantry contact aircraft in 1916–18. The main source used is Gray and Thetford [80, pp 79–81]. The engines known to have been used are: 200 hp Benz Bz IV; 185 hp C III NAG. Performance figures are given in table 53.

4.14 Fokker E.I–E.IV

The Fokker monoplanes E.I–E.IV were significant Luftstreitkräfte single-seat fighters in 1915–16. The main sources used are JM Bruce [37] and Gray and Thetford [80, pp 82–86]. These aircraft were responsible for the so-called ‘Fokker Scourge’, although the actual loss rates of British aircraft to Fokker monoplanes does not seem particularly significant [104, p 29, table 1-1]. Engines known to have been used include: 80 hp Oberursel (E.I, E.II prototype and training versions); 100 hp Oberursel U I (production E.II and E.III); 80 hp Le Rhône (E.III experimental); 100 hp Goebel Goe. I (E.III experimental); 90 hp Siemens-Halske Sh. I (E.III experimental). Performance figures are given in table 54.

- Cecil Lewis [115, pp 51–53] reports that rumour had credited the Fokker with the most fantastic performance. When a Fokker was captured it was flown against available scouts around March 1916: the Morane Bullet (Morane-Saulnier Type N), Morane Parasol (Morane-Saulnier Type L or LA, two seaters?), Morane Biplane (Morane-Saulnier Type BB), Nieuport (possibly Nieuport 16) and B.E.2c. All but the B.E.2c gave a good account of themselves, the Morane Bullet climbed quicker, was faster on the level and out-maneuvred the Fokker. The specific model of the Fokker is not given.

Table 53: D.F.W. C V performance figures. The main source used is Gray and Thetford [80, pp 79–81]. Wing span: 13.27 m.

Aircraft	C V
Weights (kg):	
Empty	970
Loaded	1430
Max speed (kph):	
	155
Climb to (min):	
1000 m	4
5000 m	49
Service Ceiling (m)	
	5000
Endurance (hrs)	
	3.5

- Franz Immelmann [105, p 77] gives the Fokker E-type a top speed of 130 kph and a ceiling of about 3,500 m which it can reach in about an hour. Franz Immelmann [105, p 143] gives the 160 hp Fokker E-type a maximum speed of 160–170 kph and climb to 3,000 m in 15 minutes.

Table 54: Fokker E.I–E.IV monoplane performance figures. The main sources used are JM Bruce [37] and Gray and Thetford [80, pp 82–86]. Wing span: E I 29 ft 3 in; E III: 30 ft 10.4 in; E IV: 32 ft 9.6 in; wing area for E I, III and IV is usually quoted as 16 m², for the E II 14 m².

Aircraft	E.I	E.III	E.III British	E.IV
Weights (lb):				
Empty	787	878	920	1025
Military Load			64	
Pilot			180	
Fuel and oil			236	
Loaded	1239	1342	1400	1593
Max speed (mph):				
10000 ft	81	87.5	79	100
Climb to (min):				
1000 m	7 00	5 00		3 00
6500 ft			12 30	
2000 m	20 00	15 00		8 00
3000 m	40 00	30 00		15 00
10000 ft			28 00	
Service Ceiling (ft)			11500	
Endurance (hrs)				
	1.5	1.5	2.75	1.5

4.15 Fokker D I–V

The Fokker D I–V were a significant Luftstreitkräfte single-seat fighters 1916. The main source used is Gray and Thetford [80, pp 87–97]. The engines known to have been used are: 120 hp Mercedes D II (D I); 160 hp Mercedes D III (D IV); 100 hp Oberursel U I (D II and D V); 160 hp Oberursel U III (D III). Performance figures are given in table 55.

4.16 Fokker Dr.I

The Fokker Dr.I was a significant Luftstreitkräfte fighter in 1917–18. The fuselage was a braced box girder structure made from welded steel tube, the wings were a wooden cantilever structure. The main sources used are JM Bruce [36] and Gray and Thetford [80, pp 98–101]. Engines known to have been used include: 110 hp Le Rhône; 110 hp Oberursel UR.II; 110 hp Goebel Goe.II; 145 hp Oberursel UR.III; 160 hp Goebel Goe.III (Fokker V.5); 160 hp Siemens-Halske Sh.3 (Fokker V.7); 130 hp Clerget 9B; 150 hp Gnome Monosoupape. Gray and Thetford state that the Swedish Thulin licensed built Le Rhône was preferred to the Oberursel, it reputedly used superior materials. Performance figures are given in table 56.

Table 55: Fokker D I–V performance figures. The main source used is Gray and Thetford [80, pp 87–97].

Aircraft	D I	D II	D III	D IV	D V
Weights (kg):					
Empty	463	384	452	606	363
Loaded	671	576	710	841	566
Max speed (kph):					
	150	150	160	160	170
Climb to (min):					
1000 m	5	4	3	3	
3000 m					19
4000 m		24	20		
Service Ceiling (m)					
Endurance (hrs)	1.5	1.5	1.5	1.5	1.5

- Rudolf Stark [137, pp 52–53] states his staffel received some Fokker triplanes in May 1918 and that ‘they were extremely sensitive to the controls and rise up in the air like a lift. You climb a few hundred metres in the twinkling of a second and can then go round and round one spot like a top’.

Table 56: Fokker Dr.I performance figures. The main sources used are JM Bruce [36] and Gray and Thetford [80, pp 98–101]. I have partly corrected some figures back to metric. The fifth column is taken from Gray and Thetford. In addition to the tabular data JM Bruce mentions that the acceptance trials of 141/17 in October 1917 recorded climbs (with 110 hp Le Rhône): to 2000 m, 4 min 10 sec; to 3000 m 8 min; to 16400 ft, 20 min 35 sec. The speed was recorded as 118 mph, regarded as over-optimistic as later trials (April 1918) the speed was recorded as 97 mph at 9200 ft, 86 mph at 13800 ft. The tabular data was from official German documents with the exception of the speed at unspecified altitudes. Wing span 7.19 m (top), 6.225 m (middle), 5.725 m (bottom); wing area 7.58 m² (top), 5.04 m² (middle), 4.86 m² (bottom), undercarriage airfoil 1.18 m², total: 18.66 m².

Engine	110 hp Le Rhône	145 hp Oberursel UR. III	160 hp Goe. III	160 hp Sh. 3	110 hp Le Rhône
Weights (lb):					
Empty	894	948	970	1082	406 kg
Military Load	130				
Pilot	176				
Fuel and oil	90				
Loaded	1290	1378	1400	1512	586 kg
Max speed (mph):					
4000 m	102.5	115	118	120	165 kph
Climb to (min):					
1000 m					2.9
2000 m	6 05	4 20	4 00		
3000 m	10 05	7 05	7 00		
4000 m	15 15	10 50	10 00		
5000 m	23 50	15 30	14 00		
Service Ceiling (ft)					
	20000	24280	27230		20000
Endurance (hrs)					
	1.5				1.5

4.17 Fokker D.VII

The Fokker D.VII was a major Luftstreitkräfte fighter introduced into service in late April 1918 becoming the most common German fighter in the late war. The fuselage was a braced box girder structure made from welded steel tube, the wings were a wooden cantilever structure. The main sources used are Peter Gray [82] and Gray and Thetford [80, pp 105–108]. Another source with part of an STAé report is Flight International 1918, p 1110 or a version of unknown provenance STAé Fokker D.VII. Engines known to be fitted are the 160 hp Mercedes DIII, 175 hp Mercedes DIIIa and 185 hp BMW IIIa. The BMW powered aircraft, known as D.VIIIf, had much

improved performance at altitude and were introduced ‘in late summer 1918’. Performance figures are given in table 57.

- ME Kähnert [109, p 27] states a Fokker D.VII flying about 800 m ‘nose-dives’ 400 m in ‘a few seconds’.
- Ernst Udet [144, pp 108–9] describes a combat in which a Breguet shot his Fokker down and he escaped from the doomed Fokker by parachute. Ernst Udet [144, pp 114–115] states that a Sopwith Camel was able to turn in tighter circles than the Fokker D.VII. Ernst Udet [144, pp 120–2] states that near ground level a S.E.5a pursuing his Fokker gained on him to initiate combat.
- Edward Sims cites Carl von Schoenbeck [135, pp 37–38] as considering the Fokker D.VII with the B.M.W. engine as the best German fighter of the war.
- Rudolf Stark [137, pp 133–135] describes the situation when his staffel first received new Fokker D.VII to replace old Albatros D.V, Pfalz D.III and Rolands on 14th August 1918. He says ‘the machines climb wonderfully and answer to the slightest movement of the controls’. Later he says ‘The more we get to know them, the better pleased we are with them. Whatever one tries — steeply banked turns, dives, loops — they always answer the controls beautifully; one catches the machine at once. They give one a magnificent feeling of safety’.
- Carl Degelow [110, p 26] says he considers the Fokker D.VII the best German fighter of the war and that it was both faster and more manoeuvrable than the Sopwith Camel. Carl Degelow [110, pp 126–129] says that, around 25th June 1918 while in Jasta 40, he received a Fokker D.VII which he found could take much more stress than other aircraft of the period.
- Victor Yeates has his character Tom Cundall [150, p 156] describe the Fokker D.VII as ‘about as good as SEs’, this was set during the German advance on Amiens and would be Mercedes powered Fokker D.VII’s.
- ‘Eric’ Crundall [70, p 162] states a Mercedes powered Fokker D.VII he flew after the war was ‘a lovely aeroplane to fly, with absolutely no vices’.

4.18 Fokker D.VIII

The Fokker D.VIII was a Luftstreitkräfte fighter in 1918 being introduced into service in August 1918. The fuselage was a braced box girder structure made from welded steel tube, the wing was a wooden cantilever structure. The main sources used are Gray and Thetford [80, pp 109–112] and JM Bruce [44]. The aircraft was first introduced to service as the Fokker E.V in August 1918. Structural failures caused the aircraft to be withdrawn from service. After the problems were resolved the aircraft was re-introduced to service with a new wing as the Fokker D.VIII in late October 1918. Engines known to be used are: 110 hp Oberursel UR.II; 110 hp Le Rhône; 145 hp Oberursel UR.III; 160 hp Goebel Goe. III; 200 hp Goebel Goe. IIIa; 160 hp Siemens-Halske Sh 3; 220 hp Siemens-Halske Sh 3a; and 130 hp Spijker-Clerget. Performance figures are given in table 58.

- Joseph Doerflinger [72, p 25] says that Staffel 6 flew the Fokker D.VIII and these were unsatisfactory since the planes wings broke off readily in a dive. This is likely to refer to the earlier E.V.

4.19 Friedrichshafen G III

The Friedrichshafen G III was a significant Luftstreitkräfte three-seat bomber in 1917–18. The main source used is Gray and Thetford [80, pp 113–116]. Engines known to have been used include: two 260 hp Mercedes D IVa. Performance figures are given in table 59.

4.20 Friedrichshafen FF floatplanes

The Friedrichshafen FF 33, 33b, 33e, 33j and 33s were a significant German Naval unarmed two-seat reconnaissance floatplanes in 1914–18. The Friedrichshafen FF 33f, 33h and 33l were German Naval two-seat fighter floatplanes in 1915–18. The FF 49 was a German Naval two-seat reconnaissance floatplane in 1917–18. The main source used is Gray and Thetford [80, pp 117–127]. The engines known to have been used: 150 hp Benz Bz III (FF 33); 200 hp Benz Bz IV (FF 49). Performance figures are given in table 60.

4.21 Gotha GI–GV

The Gotha GI–GV was a group of major Luftstreitkräfte long-range bomber in 1917–18. The main source used here is Peter Grosz [87]. Performance figures are given in table 61.

4.22 Gotha WD14 floatplane

The Gotha WD14 was a German Naval twin-engined torpedo floatplanes in 1917–18. The main source used is Gray and Thetford [80, pp 133–135]. The engines known to have been used: 2 × 200 hp Benz Bz IV. Performance figures are given in table 62.

Table 57: Fokker D.VII performance figures. The main sources used are Peter Gray [82] and Gray and Thetford [80, pp 105–108]. The third column is for a captured aircraft. The second column is an in-service performance from ‘Luftnachrichtenblatt, 1926’. However, these appear to match the figures from a STAé report date 5–6 June 1918 for a captured aircraft and other numbers from this latter report have been added to the same column, this is apparently Ostdeutsche Albatros Werke build (OAW) 2009/18 with (probably) a D.IIIa or IIIaü. The fourth column are factory figures from ‘Flugsport, 1919’. The fifth column for Udet’s D.VII is from ‘Motor, May/June 1919’. The sixth and seventh columns are from Gray and Thetford. The improved performance of the BMW engine at height is clear. Wing span 8.9 m; wing area 20.5 m².

Aircraft	STAé?	Captured	Udet 4253/18			
Engine	Merc DIII		BMW IIIa	BMW IIIa	Merc	BMW
Weights (kg):						
Empty	670	1622.5 lb			700	
Loaded	960	1936 lb			850	
Max speed (kph):						
1000 m	188.2		200			
2000 m	188				186.5	
3000 m	184	182.5				
4000 m	177					
5000 m	167					
Climb to (min):						
500 m	2 02					
1000 m	4 15	4.25	1.75		3.8	2.5
1500 m	6 01					
2000 m	8 18		4	6		
2500 m	10 59					
3000 m	13 49		7	9		
3500 m	17 33					
4000 m	22 48		10.25	12		
4500 m	29 48					
5000 m	38 05		14	16	31.5	16.0
6000 m			18.75	21		
Service Ceiling (ft)						
	6000 m				22900	
Endurance (hrs)						
					1.5	

4.23 Halberstadt CL II and IV

The Halberstadt CL II and IV were significant Luftstreitkräfte two-seat ground-attack and escort fighters in 1917–18. The main source used here is [80, pp 136–142]. The engines known to have been used include: 160 hp Mercedes D III. Performance figures are given in table 63.

4.24 Halberstadt C V

The Halberstadt C V was a minor Luftstreitkräfte two-seat photo-reconnaissance aircraft in 1918. The main source used here is [80, pp 143–145]. The engines known to have been used include: 220 hp Benz Bz IV. Performance figures are given in table 64.

4.25 Halberstadt D II and III

The Halberstadt DII and III were significant Luftstreitkräfte single-seat fighters in 1916. The engines known to have been used include: D II: 120 hp Mercedes D II; DIII: 120 hp Argus As II. The main source used here is [80, pp 146–149]. Performance figures are given in table 65.

4.26 Hannover CL II, III and IIIa

The Hannover CL II, III and IIIa were significant Luftstreitkräfte two-seat C-type escorts and close support aircraft used in 1917–18. The engines known to have been used include: 180 hp Argus As III; 160 hp Mercedes D III. The main source used here is [80, pp 150–153]. Performance figures are given in table 66.

Table 58: Fokker D.VIII performance figures. The main sources used are Gray and Thetford [80, pp 109–112] and JM Bruce [44]. The last two columns are from JM Bruce, the first is from a USAS report on P-165 at McCook Field, 20th May 1921, see also this; the second is said to be German figures. I would rather suspect the 6500 ft figure for climb in the latter is actually 2000 m. Wing span 8.4 m; wing area 10.7 m².

Aircraft	USAS	German	160 hp	160 hp
Engine	110 hp	145 hp	160 hp	160 hp
	Oberursel	Oberursel	Goe. III	Sh 3
Weights (kg):				
Empty	405			
Loaded	605			
Weights (lb):				
Empty	848	893		
Military Load	74			
Pilot	180			
Fuel	113			
Oil	23			
Loaded	1238	1334		
Max speed (kph):				
Ground level	204			
Max speed (mph)				
ground level	115	125		
6500 ft	113.8			
10000 ft	112.3			
15000 ft	107.8			
20000 ft	90.0			
Climb to (min):				
1000 m	2		2 00	4 00
6500 ft		5.1	4 30	
3000 m			7 30	
10000 ft		8.9		
4000 m	10.75		10 45	
4500 m				11 30
15000 ft		16.7		
5000 m		15 00	14 00	
6000 m			21 00	
20000 ft		34.7		
20650 ft		39.4		
Service Ceiling (m)	6000	20650 ft		
Endurance (hrs)	1.5		1.5	

Table 59: Friedrichshafen G III performance figures. The main source used is Gray and Thetford [80, pp 113–116].

Aircraft	G III
Weights (kg):	
Empty	2695
Loaded	3930
Max speed (kph):	135
Service Ceiling (m)	
Endurance (hrs)	5

Table 60: Friedrichshafen FF 33 and 49 floatplane variant performance figures. The main source used is Gray and Thetford [80, pp 117–127].

Aircraft	33e	33l	49c
Weights (kg):			
Empty	1008	916	1515
Loaded	1635	1373	2147
Max speed (kph):			
	119	136	139.5
Climb to (min):			
1000 m	17.5	8	8
Service Ceiling (m)			
Endurance (hrs)	5–6	5–6	5.5

4.27 Junkers J I

The Junkers J I was an all-metal Luftstreitkräfte two-seat close support aircraft used in 1917–18. The J I (factory designation J 4) was armoured in addition to being made of metal: a completely armoured nose capsule of 5 mm chrome-nickel sheet steel enclosed the engine and crew compartment and terminated with a solid bulkhead. The engines known to have been used include: 200 hp Benz Bz IV. The main source used here is [80, pp 154–157]. Performance figures are given in table 67.

4.28 Junkers Monoplanes

The Junkers D.I (factory designation J-9) was an all-metal monoplane Luftstreitkräfte fighter that entered service in late 1918. The Junkers CL.1 was a two-seat escort and ground attack fighter that entered service in late 1918. The engines known to have been used for the D.I include: 185 hp BMW IIIa; 200 hp BMW IIIb. The engines known to be used for the CL.I include: 180 hp Mercedes DIIIa. The main source used here are Gray and Thetford [80, pp 433–434] and Cowin [69]. Performance figures are given in table 68.

4.29 L.F.G. Roland CII

The Roland C.II–C.IIa was a significant Luftstreitkräfte two-seat reconnaissance and escort fighter in 1916–17. It was as fast as the contemporary allied single-seat fighters Nieuport 11 and Sopwith Pup. It was later used as a two-seat trainer. The main sources used are Peter Grosz [89] and Gray and Thetford [80, pp 158–161]. The main engine type used was the 160 hp Mercedes D.III. Performance figures are given in table 69.

- Gwilym Lewis [116, p 43] on 18th June 1916 describes the Roland as ‘the Hun’s best machine now’ and [116, p 78] the ‘finest two-seater machine in the world’.

4.30 L.F.G. Roland D II and IIa

The Roland D II–IIa was a significant Luftstreitkräfte single-seat fighter in 1916–17. The main source used is Gray and Thetford [80, pp 162–165]. The main engine type used: 160 hp Mercedes D.III (D II); 180 hp Argus As III (D IIa). Performance figures are given in table 70.

4.31 L.F.G. Roland DVIa and VIb

The Roland D VIa and VIb were minor Luftstreitkräfte single-seat fighters in 1918. The main source used is Gray and Thetford [80, pp 166–168]. The main engine types known to have been use: 160 hp Mercedes D III (VIa); 200 hp Benz Bz III (VIb). Performance figures are given in table 71.

4.32 L.V.G. B I, II and III

The L.V.G. B I, II and III were Luftstreitkräfte two-seat reconnaissance and training aircraft in 1914–17. The shift to training duties began in early 1915. The main source used is Gray and Thetford [80, pp 169–172]. The main engine types known to have been use: 100 hp Mercedes D I; 120 hp Mercedes D II (B II and III). Performance figures are given in table 72.

4.33 L.V.G. C II, V and VI

The L.V.G. C II, V and VI were Luftstreitkräfte two-seat reconnaissance and artillery observation aircraft in 1915–17 (C II), 1917–18 (CV) and 1918 (C VI). The C II was used for a mix of light bombing, tactical reconnaissance and photo reconnaissance. The C V and C VI were particularly used for medium range photo-reconnaissance. The main source used is Gray and Thetford [80, pp 173–182]. The main engines types known

Table 61: Gotha GI–GV performance figures. The main source is Peter Grosz [87]. The G.Vb could carry a bomb load of 1600 kg (3250 lb).

Aircraft	G.I	G.II	G.III	G.IV	G.IV (SSW)	G.IV (SSW)	G.IV (SSW)	G.IV (SSW)	G.IV (SSW)	G.IV (SSW)	G.IV (IVG)	G.V	G.Va	G.Vb
Engine	160	220	260	260	1078/16	260	260	245	185	260	260	26	260	260
	D.III	D.IV	D.IVa	D.IVa	D.IVa	D.IVa	D.IVa	Mb.IVa	C111	D.IVa	D.IVa	D.IVa	D.IVa	D.IVa
Weights (kg):														
Empty	1800	2180	2383	2413	2554.6	2621	2621	2505	2621	2265	2740	2740	2740	2590
Loaded	2800	3190	3618	3648	3789.6	3856	3856	2905	3856	3500	3975	3975	3975	4550
Max speed (kph):	130	135	135	135	135	120		125	120	135	140	140	140	135
Service Ceiling (m)	2700			5000	4500	4600					4000		6500	
Endurance (hrs)	4	4	3.25	3.25–6										6

Table 62: Gotha WD14 floatplane performance figures. The main source used is Gray and Thetford [80, pp 133–135]. Wing span: 25.5 m; wing area 132 m².

Aircraft	WD14
Weights (kg):	
Empty	3150
Loaded	4642
Max speed (kph):	130
Climb to (min):	
1000 m	13.1
1500 m	23
Service Ceiling (m)	
Endurance (hrs)	8

Table 63: Halberstadt CL II and V performance figures. The main source is Gray and Thetford [80, pp 136–142]. Bomb load: 4 or 5 × 10 kg (22 lb) bombs.

Aircraft	CL II	CL V
Weights (kg):		
Empty	773	728
Loaded	1133	1068
Max speed (kph):		165
5000 m	165	
Climb to (min):		
1000 m	5	
5000 m	39.5	32
Service Ceiling (ft)		
	16700	
Endurance (hr)		
	3	3–3.5

Table 64: Halberstadt C V performance figures. The main source is Gray and Thetford [80, pp 143–145].

Aircraft	C V
Weights (kg):	
Empty	930
Loaded	1365
Max speed (kph):	170
Climb to (min):	
2000 m	3.2
5000 m	23
Service Ceiling (ft)	
Endurance (hr)	3.5

Table 65: Halberstadt D II and III performance figures. The main source is Gray and Thetford [80, pp 146–149]. The citation does not specify to which model the figures apply to.

Weights (kg):	
Empty	561
Loaded	771
Max speed (kph):	145
Climb to (min):	
1000 m	4
3000 m	15
Service Ceiling (ft)	
	19600

Table 66: Hannover CL II, III and IIA performance figures. The main source is Gray and Thetford [80, pp 150–153].

Aircraft	Captured	
Weights (kg):		
Empty	717	1732 lb
Loaded	1081	2572 lb
Max speed (kph):		
5000 m	165	
Climb to (min):		
1000 m	5.3	
Service Ceiling (ft)		
24000		
Endurance (hrs)		
3		

Table 67: Junkers J I performance figures. The main source is Gray and Thetford [80, pp 154–157].

Weights (kg):	
Empty	1766
Loaded	2176
Max speed (kph):	
155	
Climb to (min):	
2000 m	32
Endurance (hrs)	
2	

Table 68: Junkers D.I and CL.1 performance figures. The main source is Gray and Thetford [80, pp 154–157] and Cowin [69].

Aircraft	D.I	D.I (early)	D.I (late)	CL.I	CL.I
Weights (kg):					
Empty	654		1420 lb	710	1620 lb
Loaded	834		1840 lb	1050	2345 lb
Max speed (kph):					
	185	149 mph	145 mph	161	118 mph
Climb to (min):					
1000 m	2.3			3.9	
Service Ceiling (ft)					
			19700		17000
Endurance (hrs)					

Table 69: Roland C.II and C.IIa performance figures. The main sources used are Peter Grosz [89] and Gray and Thetford [80, pp 158–161]. The fourth column is from Gray and Thetford. Wing span C.II: 10.33 m (upper), 10.03 m (lower); C.IIa: 10.23 m (upper), 9.96 m (lower); wing area C.II: 27.96 m², C.IIa: 29.00 m².

Aircraft	C.II	C.IIa	C.IIa(Li)	C.II
Weights (kg):				
Empty	789	714	831	764
Load	520	500	515	
Loaded	1309	1214	1331	1284
Max speed (kph):				
	165	165	165	165
Climb to (min):				
1000 m	7	6		6
2000 m	14	14.5		12
3000 m	26	29.5		
4000 m				45
Service Ceiling (ft)				
Endurance (hrs)				
	4	4	4	4–5

Table 70: Roland D II and D IIa performance figures. The main source used is Gray and Thetford [80, pp 162–165].

Aircraft	D II	D IIa
Weights (kg):		
Empty	715	635
Loaded	954	795
Max speed (kph): 170		
Climb to (min):		
5000 m	23	20
Service Ceiling (ft)		
Endurance (hrs)		

Table 71: Roland D VIa and D VIb performance figures. The main source used is Gray and Thetford [80, pp 166–168]. The second column is from a VIb tested in the USA post-war (P-132 tested 4th August 1920 see here).

Aircraft	D VIb	
Engine	200 hp Benz	
Weights (kg):		
Empty	650	1523 lb
Military Equipment		137 lb
Pilot		180 lb
Fuel		132 lb
Oil		15 lb
Loaded	860	1987 lb
Max speed (kph): 182.5		
Max speed (mph):		
Ground		114
6500 ft		111.5
10000 ft		108
15000 ft		99
17400 ft		90
19000 ft		79
Climb to (min):		
1000 m	2.5	
3000 m	9	
6000 m	28	
6500 ft		6.5
10000 ft		11.5
15000 ft		24.0
17400 ft		38.3
Service Ceiling (ft) 17400		
Endurance (hrs) 2		

Table 72: L.V.G. B I, II and III performance figures. The main source used is Gray and Thetford [80, pp 169–172].

Aircraft	B II
Engine	100 hp
	D I
Weights (kg):	
Empty	726
Loaded	1074
Max speed (kph):	
1000 m	105
Climb to (min):	
1000 m	12
Service Ceiling (ft)	
Endurance (hrs)	4

to have been use: 160 hp Mercedes D III (C II); 200 hp Benz BZ IV (C V and C VI). Performance figures are given in table 73.

Table 73: L.V.G. C II, V and VI performance figures. The main source used is Gray and Thetford [80, pp 173–182]. For the C VI the bomb load is given as up to 250 lb.

Aircraft	C II	C V	C VI	C VI Captured
Weights (kg):				
Empty	845	1013	930	2090 lb
Loaded	1405	1533	1309	3036 lb
Max speed (kph):				
2000 m	130		170	
4000 m		164		
		150		
Climb to (min):				
1000 m			4	
3000 m			15	
4000 m		35		
6000 m			40	
Service Ceiling (ft)	13120		21350	
Endurance (hrs)	4	3.5	3.5	

4.34 Pfalz E I, II and IV

The Pfalz E I, II and IV were Luftstreitkräfte single-seat fighter aircraft in 1915–16. The main source used is Gray and Thetford [80, pp 183–186]. The main engine types known to have been use: 80 hp Oberursel U O (E I); 100 hp Oberursel U I (E II); 160 hp Oberursel U III (E IV). Performance figures are given in table 74.

4.35 Pfalz DIII and DIIIa

The Pfalz DIII was a significant Luftstreitkräfte fighter in 1917–18. The main sources used are Peter Gray [83] and Gray and Thetford [80, pp 187–190]. Gray and Thetford state that the Allied assessment of a captured aircraft (4184/17) was that the view was excellent in all directions, the aircraft was stable laterally and unstable directionally and longitudinally (interpreted as meaning good manoeuvrability) and was stated to answer well to controls ‘much better than does the Albatross DV’. Engines known to be fitted are 160 hp Mercedes DIII and 175/180 hp Mercedes DIIIa. Performance figures are given in table 75.

- While flying the Pfalz DIII Rudolf Stark [137, p 47] on 23rd April 1918 records that ‘The English have new machines with which they can fly at great heights, unattainable to us. At five thousand metres our machines are uncertain swimmers and sideslip in their turns’.
- Carl Degelow [110, pp 124–125] says that, in May 1918 while in Jasta 40, he selected a Pfalz D.IIIa over an Albatros D.Va due to their superior wing structure allowing a more stressful dive where the Albatros

Table 74: Pfalz E I, II and IV performance figures. The main source used is Gray and Thetford [80, pp 169–172].

Aircraft	E I	E II	E IV
Weights (kg):			
Empty	345	410	471
Loaded	535	620	694
Max speed (kph):			
	145	150	160
Climb to (min):			
800 m	3	2.75	2
2000m	12	9.75	8.5
Endurance (hrs)			1

lower-wing spar might break under stress. The Pfalz is described as a bit underpowered not climbing as well as the Albatros, but was safer.

Table 75: Pfalz DIII performance figures. The main sources used are Peter Gray [83] and Gray and Thetford [80, pp 187–190]. The endurance is stated to be 2 to 2.5 hours. The figures for 4184/17 are for a captured aircraft, see also Flight [77] where it is identified as G 141. The figures for DIIIa 5935/17 are from a test flight on 4th February 1918. Wing span 9.4 m; wing area 22.17 m².

Aircraft	4125/17 DIII	8143/17 DIIIa	8282/17 DIIIa	4184/17	5935/17
Weights (kg):					
Empty	695	695	725	1532 lb	
Military load				101 lb	
Crew				180 lb	
Loaded	865	915	905	2056 lb	911
Max speed (kph):			165		
Max speed (mph):					
				102.5	
				91.5	
Climb to (min):					
			3.25		
			7.25		
			11.75		
					33
Climb to (min):					
				6 55	
				17 30	
				41 20	
Service Ceiling (ft)				17000	
Endurance (hrs)		2-2.5			

4.36 Pfalz DXII

The Pfalz DXII was a significant Luftstreitkräfte fighter in 1918. The main sources used here are Peter Gray [88] and Gray and Thetford [80, pp 191–194]. The Pfalz DXII was not popular, largely due to the favourable publicity for the Fokker D.VII. Engines known to be fitted include 170/180 hp Mercedes DIIIa and DIIIaü, the 185/195 hp BMW IIIa and 195 hp Benz Bz IIIboü. Performance figures are given in table 76.

- Rudolf Stark [137, pp 149–150] states that his unit received some Pfalz DXII on 1st September 1918. They were viewed unfavourably at first, but were found to keep up with the Fokkers, dived faster, but were heavier for turns and general fighting purposes. The Fokkers were still regarded as superior, but the DXII was acceptable.

Table 76: Pfalz DXII performance figures. The main sources used are Peter Gray [88] and Gray and Thetford [80, pp 191–194]. These figures are stated to be performance at the Second Fighter Competition (May–June 1918). The loads are a partial representation of those given for the Typenprüfung 19th June 1918. The sixth and seventh columns are from Gray and Thetford. Wing span 9.000 m (upper), 7.900 m (lower); wing area 11.70 m² (upper), 10.00 m² (lower).

Aircraft	D.XII	D.XII	D.XII	D.XIIa	D.XIV	D.XII	
Engine	D.IIIa	D.IIIaü	BMW.IIIa	Bz.IIIboü	Bz.IVü	Merc	BMW.III
Effective h.p.	170	180	195	195	200		
Weights (kg):							
Empty	722				842	716	
‘useful’ load	180				190		
Propulsion load	208.5						
Framework load	313.5						
Loaded	902.0				1032	897	
Power loading (kg/hp)	5.3	5.0	4.5	4.9	5.2		
Wing loading (kg/m ²)	41.4	41.4	40.7	43.5	40.6		
Max speed (kph):	170	180	185		190	170	
Climb (km/min):							
0–1	3.8	2.5	2.1	4.0	2.2	3.4	2.7
1–2	4.0	3.6	3.3	4.5	3.5		
2–3	5.3	5.2	3.3	5.5	5.3		
3–4	7.7	7.4	3.9	6.0	5.3		
4–5	14.0	12.0	5.0	12.0	5.5		
5000 m						29.9	21.0
5–6			7.0				
Service Ceiling (ft)						18500	
Endurance (hrs)						2.5	

4.37 Rumpler C types

The Rumpler C I, Ia, IV, V, VII and Rubild were significant Luftstreitkräfte two-seat C-type general duties (C I and Ia) or long-range reconnaissance and photo-reconnaissance aircraft used in 1915–18 (C IV, VII and Rubild). The Rumpler C VIII was a training machine. The later Rumpler aircraft had good high altitude performance and were very difficult to intercept by contemporary allied fighters.

The engines known to have been used include: C I, Ia and C VIII: 180 hp Argus As III; 160 hp Mercedes D III or 150 hp Benz Bz III; C IV and V: 260 hp Mercedes D IVa; C VII and Rubild: 240 hp Maybach Mb IV. The Rubild was apparently the Rumpler C VI. The main source used here is Gray and Thetford [80, pp 195–207]. Performance figures are given in table 77.

- Hooton [104, p 71] discusses the German use of the high-altitude Rumpler aircraft with slowly moving celluloid film in modified movie cameras which could photograph a strip 100 km long and several kilometers wide flying above allied fighters. This acted as a cue to select areas for detailed photography using the plate cameras of the lower altitude FA(Lb) photo-reconnaissance machines.
- Haupt Heydemarck [100, pp 30, 36–42, 56, 107–114, 135–140, 147–148] who appears to have flown in a Rumpler C.I during 1916 judging from illustrations 13–16, discusses long distance reconnaissance operations in which they cross the lines at around 2,500 m and reach an altitude of 3,000 m carrying two 20 kg bombs. A 50 kg bomb was flown to Mailly, around 100 km from their aerodrome. Two unknown weight bombs were carried to at least 4,000 m. Four 12.5 kg bombs were carried to La Cheppe.
- Haupt Heydemarck [101, pp 166–180] describes plate cameras moving from early plates of 9 × 12 cm to later plates of 13 × 18 cm, then being replaced by a ‘serial filming’ apparatus (movie film) that enabled them to photograph a stretch of country of about 4 km wide and up to 80 km long on a single trip.

4.38 Siemens Schuckert DI

The Siemens-Schuckert DI was a minor Luftstreitkräfte fighters in 1917. The main sources used is Gray and Thetford [80, pp 209–212]. Engines known to be fitted are: 110 hp Siemens Halske Sh I. Performance figures are given in table 78.

Table 77: Rumpler C I, Ia, IV, V, VII, Rubild and VIII performance figures. The main source is Gray and Thetford [80, pp 195–207] also Flight [78]. The C I or Ia could carry a bomb load of less than about 100 kg. The C IV could carry 4×25 kg bombs on short-range sorties.

Aircraft	C I	C IV	C V G 117	C VII	C VIII
Weights (kg):					
Empty	793	1080	2439 lb	1050	874
Loaded	1333	1530	3439 lb	1485	1374
Max speed (kph):					
	152			140	
500 m		106 mph			
1000 m		171		175	
2000 m		169.0			
3000 m		165.5			
10000 ft			100.5 mph		
4000 m		160.0			
15000 ft				87	
5000 m		150			
6000 m				160	
Climb (min)					
500 m		2.00			
1000 m		3.75		2.3	4.25
2000 m		8.4		4.3	11.0
3000 m		14.25		8.0	21.0
10000 ft			16 00		
4000 m		21.75		13.0	37.5
5000 m		38.00		21.5	
6000 m				33.0	
7000 m				50.0	
Service Ceiling (ft)					
		21000	15500	23944	
Endurance (hrs)					
		4	4	3.5	4

Table 78: Siemens Schuckert DI performance figures. The main sources used are Gray and Thetford [80, pp 212]. Wing span: 7.50 m; wing area: 14.4 m².

Aircraft	DI
Weights (kg):	
Empty	430
Loaded	675
Max speed (kph):	
	155
Climb to (min):	
1000 m	3.5
2000 m	8.0
3000 m	14.5
4000 m	24.3
Service Ceiling (m)	
Endurance (hrs)	
	2.5

4.39 Siemens Schuckert DIII and DIV

The Siemens-Schuckert DIII and DIV were potentially significant Luftstreitkräfte fighters in 1918. The main sources used are Peter Gray [85] and Gray and Thetford [80, pp 213–217]. The initial deployment was in April/May 1918. Engine reliability prevented them being used more widely before the Armistice. A combination of relatively slow rotation plus low-grade castor oil resulted in piston seizure after 7–10 hours running. The DIII were withdrawn from the front in May 1918. After modifications to the engine and airframes they were returned to operations in July 1918, primarily as interceptors. Engines known to be fitted are: 160 hp Siemens Halske Sh III; and 200 hp Siemens Halske Sh IIIa. Performance figures are given in table 79.

Table 79: Siemens Schuckert DIII and DIV performance figures. The main sources used are Peter Gray [85] and Gray and Thetford [80, pp 213–217]. The first set of figures for the DIII are described as official German Baubeschreibung figures, the set for the DIV as G.P. Neumann figures.

Aircraft	DIII	DIII	DIV
Weights (kg):			
Empty	534		540
Loaded	725		735
Max speed (kph):			
	180		190
Climb to (min):			
1000 m	1.75		1.9
2000 m	3.75		3.7
3000 m	6		6.4
4000 m	9		9.1
5000 m	13		12.1
6000 m	20		15.5
8100 m		36	
Service Ceiling (m)			
	8000		8000
Endurance (hrs)			
	2		2

4.40 Zeppelin Staaken R VI

The Zeppelin Staaken R VI, the main production version of any ‘R’ type, were small in number but the most significant Luftstreitkräfte seven-man long-range giant bomber used in 1917–18. The main source used is Gray and Thetford [80, pp 218–222]. The engine types known to have been used: 4 × 245 hp Maybach Mb IV; 260 hp Mercedes D IVa. The Maybach was the better engine. Performance figures are given in table 80.

Table 80: Zeppelin Staaken R VI performance figures. The main source used is Gray and Thetford [80, pp 218–222]. Bomb load could be up to 2000 kg for short ranges, possibly 750 kg for raids on London or Le Havre. 100 kg bombs were stowed internally. 300 and 1000 kg bombs were carried under the belly only partially enclosed.

Weights (kg):	
Empty	7921
Loaded	11848
Max speed (kph):	
	135
Climb to (min):	
3000 m	43
Service Ceiling (ft)	
	4320
Endurance (hrs)	
	7–10

5 Italy

5.1 Ansaldo A-1 Balilla (Hunter)

Ansaldo made a range of one and two-seat aircraft which were mainly used by the Italian air service during 1917–18. The A-1 Balilla was a single-seat fighter used in small numbers in 1917–18 mainly for home defence. The main source used is JWR Taylor [139, pp 196–7]. Engines known to have been used include: 220 hp S.P.A 6A. Performance figures are given in table 81.

Table 81: Ansaldo A-1 performance figures. The main source is JWR Taylor [139, p 197].

Aircraft	A-1
Weights (lb): Loaded	1951
Max speed (mph):	137
Service Ceiling (ft)	16400
Endurance (hrs)	1.5

5.2 Ansaldo S.V.A. Scouts

Ansaldo made a range of one and two-seat aircraft which were mainly used by the Italian air service during 1917–18. The S.V.A. (Savoia Verduzio Ansaldo) designs numbered from 3 to 10 were produced in varying numbers. Intended as a fighter they were used more as a reconnaissance aircraft and occasionally as a light bomber. The main source used is Gianni Cattaneo [65]. Engines known to have been used include: 250 hp Isotta-Fraschini V6; S.P.A 6; 220 hp S.P.A 6A. Performance figures are given in table 82.

Table 82: Ansaldo S.V.A Scout performance figures. The main source is Gianni Cattaneo [65].

Aircraft	S.V.A.4	S.V.A.3 rid.	S.V.A.5	S.V.A.5 I.F.	S.V.A.9	S.V.A.10	S.V.A.10 I.F.	S.V.A. Lorraine L-D
Engine	S.P.A. 6A	S.P.A. 6A	S.P.A. 6A 205–220 hp	I.F. V6	S.P.A 6	S.P.A. 6	I.F. V6	
Weights (lb): Empty	1545	1470	1500	1470	1525	1610	1610	1415
Loaded	2150	1965		2150	2180	2340	2365	1940
Max speed (mph):	134	140	143	147	137	131	134	134
Climb to (m. s.):								
1000 m			2 40					
2000 m			6 00					
3000 m	12 00	11 30	10 00	8 00	14 00	11 00	12 00	10 00
4000 m			12 50					
5000 m			18 00					
6000 m			25 00					
Service Ceiling (ft)								
Endurance (hrs)	3–4	3	3	3	3	3–5	3–5	3

5.3 Caproni Ca 32 and 33

The Caproni Ca 32 and 33 were four-man three-engine large bombers used in 1915–18 mainly as night bombers by the Italian air service, but also were produced and used by the Aviation Militaire. Two engines were tractor mounted and one pusher mounted. The main source used is JWR Taylor [139, pp 202–3] and JM Bruce [59, pp 185–189]. According to JM Bruce the aircraft was designated Ca.I at the time of testing and Ca 32 is a post-war designation. Engines known to have been used include: 100 hp Fiat A.10 (Ca 32); 150 hp Isotta-Fraschini V4B (Ca 33). Performance figures are given in table 83.

5.4 Caproni Ca 40–43

The Caproni Ca 40 to 43 were four-man three-engine triplane large bombers used in 1917–18 mainly as night bombers by the Italian air service. The Ca 40 series were used by both the Italian naval and army air services and a few were purchased by the RNAS. Two engines were tractor mounted and one pusher mounted. The main source used is JWR Taylor [139, pp 202–3]. Engines known to have been used include: 200 hp Isotta-Fraschini; 270 hp Fiat, Isotta-Fraschini or Liberty engines. Performance figures are given in table 84.

5.5 Caproni Ca 44–47

The Caproni Ca 44 to 47 were four-man biplane three-engine large bombers used in 1917–18 mainly as night bombers by the Italian air service. The Ca 44 series was of improved aerodynamic form and much smaller than

Table 83: Caproni Ca 32 and 33 performance figures. The main sources are JWR Taylor [139, p 203] and JM Bruce [59, pp 185–189]. The latter contributes the first column.

Aircraft Engine	Ca 32 3× Fiat A.10	Ca 32	Ca 33
Weights (kg):			
Empty	2000		
Loaded	3000		
Weights (lb):			
Loaded		6252	7302
Max speed (kph):	121		
Max speed (mph):		81	94
Climb to (m. s.):			
1000 m	10		
2000 m	22		
Service Ceiling (m)	4000		
Service Ceiling (ft)			13450
Endurance (hrs)			

Table 84: Caproni Ca 40–43 performance figures. The main source is JWR Taylor [139, p 203]. Bomb load: up to 3910 lb of bombs (Ca 42).

Aircraft	Ca 42	Ca 43
Weights (lb):		
Loaded	16535	16314
Max speed (mph):	87	81
Service Ceiling (ft)		9840
Endurance (hrs)	7	

Ca 40 series. The Ca 44 series was produced not only in Italy, but also in France and the USA. Two engines were tractor mounted and one pusher mounted. The main source used is JWR Taylor [139, pp 203–5]. Engines known to have been used include: 250 hp Isotta-Fraschini V4B; 300 hp Fiat A.12*bis*; 400 hp Liberty engines. Performance figures are given in table 85.

Table 85: Caproni Ca 44–47 performance figures. The main source is JWR Taylor [139, p 205]. Bomb load: up to 1188 lb (Ca 46).

Aircraft Engines	Ca 46 3 × 300 hp Fiat A.12 <i>bis</i>
Weights (lb):	
Loaded	11685
Max speed (mph):	94
Service Ceiling (ft)	14760
Endurance (hrs)	4

5.6 Macchi M.5

The Macchi M.5 was a single-seat flying boat fighter used in 1917–18 by the Italian naval air service. The main source used is JWR Taylor [139, pp 217–9]. Engines known to have been used include: 160 hp Isotta-Fraschini V4B. Performance figures are given in table 86.

Table 86: Macchi M.5 performance figures. The main source is JWR Taylor [139, p 219].

Aircraft	M.5
Weights (lb): Loaded	2138
Max speed (mph):	118
Service Ceiling (ft)	15100
Endurance (hrs)	

6 Russia

6.1 Anatra

The Anatra Voisin-Ivanov (VI) was a two-seat reconnaissance aircraft derived from the Voisin Type 5 used in 1915–18 by the Russian air service. The Anatra Dekar or Anatra D or Anade was a two-seat reconnaissance aircraft derived from a German Albatros design. The Anatra DS or Anasal was an Anatra D with a more powerful engine. The main source used is JWR Taylor [139, pp 562–5]. Engines known to have been used include: 150 hp Salmson Canton-Unné (VI); 100 hp Gnome Monosoupape (D); 130 hp Clerget (D); 150 hp Salmson Canton-Unné (DS). Performance figures are given in table 87.

Table 87: Anatra VI, D and DS performance figures. The main source is JWR Taylor [139, pp 563 and 565].

Aircraft	VI	D	DS
Weights (lb): Loaded	2646	1907	2566
Max speed (mph):	77.7	82	89.5
Service Ceiling (ft)	11482	13123	14107
Endurance (hrs)	3.5	3.5	3.5

6.2 Lebed' 12

The Lebed' 12 was a two-seat reconnaissance aircraft used in 1916–18 by the Russian air service. The design was based on that of a captured Albatros, probably a B.II. The main source used is JWR Taylor [139, pp 582–583]. Engines known to have been used include: 150 hp Salmson; 160 hp Salmson. Performance figures are given in table 88.

Table 88: Lebed' 12 performance figures. The main source is JWR Taylor [139, p 583].

Aircraft	Prototype	Lebed' 12
Weights (lb): Loaded		1672
Max speed (mph):	84	82.6
Climb: (m. s.)		
1640 ft	6 00	
3280 ft	13 00	
6560 ft	28 00	
Service Ceiling (ft)	9740	11482
Endurance (hrs)		3

6.3 Shchetinin M-5 to M-15

The Shchetinin M-5 was a two/three-seat flying boat trainer and reconnaissance aircraft used in 1915–18 by the Russian Imperial naval air service. The M-9 was a two-seat reconnaissance-bomber flying boat. The M-15 was a two-seat reconnaissance flying-boat. The main source used is JWR Taylor [139, pp 603–5]. Engines known to have been used include: 100 hp Gnome Monosoupape (M-9); 150 hp Salmon Canton-Unné (M-9); 220 hp Renault (M-9); 140 hp Hispano-Suiza. Performance figures are given in table 89.

Table 89: Shchetinin M-5, M-9 and M-15 performance figures. The main source is JWR Taylor [139, pp 603 and 605].

Aircraft	M-5	M-9	M-15
Weights (lb):			
Loaded	2116	3395	2910
Max speed (mph):	65	68	78
Service Ceiling (ft)	11482	9842	11482
Endurance (hrs)	4	3.5	5.5

6.4 Sikorsky Il'ya Muromets

The Sikorsky Il'ya Muromets was a series of four-engined heavy bombers produced from 1914–1917 and used by the Russian Imperial Army air service. The main source used is JWR Taylor [139, pp 604–607]. Engines known to have been used include: 2×135 hp and 2×200 hp Salmson (IM-B); 4×150 hp Sunbeam 8-cylinder; 4 Argus or Sunbeam engines totaling 500–560 hp (IM-G1); 4 RBZ-6 or MRB six-cylinder engines with a total of 600 hp (IM-G2); 2×150 hp RBZ-6 and 2×220 hp Renault (IM-G3); 4×220 hp Renault 12-cylinder (IM-Ye1). Performance figures are given in table 90.

Table 90: Sikorsky Il'ya Muromets performance figures. The main source is JWR Taylor [139, p 607]. A 920 lb bomb was tested on a IM-V.

Aircraft	IM-B	IM-V	IM-G2	Im-Ye1
Weights (lb):				
Loaded	10572	10130	11684	15432
Max speed (mph):	60	75	71.5	85
Service Ceiling (ft)	6560	9840	9840	10500
Endurance (hrs)	4	5	6	4

6.5 Sikorsky S-types

The Sikorsky S-16 was a two-seat reconnaissance and escort aircraft used in 1916 by the Russian Imperial Army air service. The main source used is JWR Taylor [139, pp 607]. Engines known to have been used include: 80 hp Gnome; 100 hp Gnome Monosoupape; 60 hp Kalep. An experimental S-17 was developed from the S-16 which was armoured and powered by a 150 hp Sunbeam engine. The Sikorsky S-20 was developed from the S-16 and Nieuport 17. Engines known to have been used include: 80 hp Le Rhône; 110 hp Le Rhône. Performance figures are given in table 91.

Table 91: Sikorsky S-16 and S-20 performance figures. The main source is JWR Taylor [139, pp 607 and 609].

Aircraft	S-16	S-20
Engine		110 hp Le Rhône
Weights (lb):		
Loaded	1490	1654
Max speed (mph):	73	118
Climb (m. s.)		
6540 ft		6 20
Service Ceiling (ft)	11482	20470
Endurance (hrs)		

7 United Kingdom

Cecil Lewis describes the aircraft testing in the Testing Squadron [115, pp 130–133]. ‘Machines were tested for their rates of climb, light and loaded, for their speeds at ground level and at various heights, for absolute ceiling (as high as the machine would go), and, in the case of scouts for manoeuvrability and safety in diving’. Specifics of how the measurements were made, or of corrections applied are not given. A useful reference is an article by H T Tizard [143] in *Flight*. Captain Coales [66] describes use of trials data to provide a basis of comparison. Some estimated information for the time to complete a 360° turn is given by FH Bramwell [14] for Sopwith Camel (8–10 s), D.H.4 (15–20 s), F.B.27 (20–30 s) and H-P O/400 (30 s); time for a complete loop in a Sopwith Pup is about 5 s and for a Martinsyde (presumably F.3) is about 10 s. PR Hare [94, pp 44–45] states that report M84 on S.E.5 A4845 gives time for a complete turn of 360° as 12 s.

One useful table of British performance measurements, but unknown provenance, lists a number of machine types and the report number as well as a summary of the actual measured data British Table of Performance. This states that service ceiling was the height at which the rate of climb dropped to 100 ft/min.

According to Hooton [104, p 86] in 1916 British single-engined day bombers carried up to twelve 20–25 lb (9.11–11.3 kg) bombs then either two 112 lb (50.8 kg) bombs or one 230 lb (104 kg) bombs. During 1918 a 1,600 lb (725 kg) was introduced in August and a 1,700 lb (816 kg) bomb in September.

Vivian Drake mentions an early test of an electrically-heated flying suit [73, pp 95–96] which was used by an observer and while it performed well in the initial part of the climb started to overheat.

P E Butcher [64] provides a engine fitter’s view of the war from the point of view of an RFC mechanic from pre-WWI through to the 1921 intervention in Russia.

7.1 Airco D.H.2

The de Havilland D.H.2 was a single-seat pusher fighter (scout) used by the RFC in 1915–17. The main source used in this summary is JM Bruce [30, 41, 43, 59]. The first operational D.H.2 was 4732 which was sent to France for operational evaluation on 26th July 1915 [59, p 42]. The first RFC fighter squadron, 24 squadron, was equipped with D.H.2s when it started operations on 7th February 1916. The main engines used were 100 hp Gnome Monosoupape, 110 hp Le Rhône 9J. Performance figures are given in table 92.

- James McCudden [119, pp 119–120] describes the first combat he had flying the D.H.2 against the Albatros D1 finding they were better machines than the D.H.2. James McCudden [119, pp 124–6] in December 1916 describes the D.H.2 as being outclassed by the Albatros D1, he then states that the D.H.2 ceiling was on average about 14,500 ft. James McCudden [119, p 127–8] on 27th December 1916 compared the D.H.2 and Albatros (DI and DII) saying the Albatros was 15 mph faster and had almost twice the climb rate.
- Gwilym Lewis [116, p 66] on 14th August 1916 describes the D.H.2 diving at up to 130 mph. Gwilym Lewis [116, p 75–76] on 23rd October 1916 states the D.H.2 was becoming more like the ‘Longhorn’ (i.e., obsolete in combat).

7.2 Airco D.H.4

The D.H.4 was a major RNAS/RFC/RAF day bomber and reconnaissance aircraft in 1917–18. The main source used in this summary is JM Bruce [17, 34, 59]. When used as a photo-reconnaissance machine the speed of the D.H.4 allowed it to be used unescorted. Hooton [104, p 70] quotes an official German memorandum by Kurt Wolff ‘For long-range reconnaissance mostly (the British) use a fast machine which, through its speed alone, is almost impossible to shoot down’.

Engines known to be used include: 200 hp BHP; 230 hp Siddeley Puma; 230 hp Galloway Adriatic; 250 hp Rolls-Royce Mk III and IV (284 hp Eagles III and IV); 275 hp Rolls-Royce Mk II and III (322 hp Eagle VI and 325 hp Eagle VII); 375 hp Rolls-Royce Eagle VIII; 353 hp Rolls-Royce Experimental ‘G’; 200 hp RAF 3a; 200 hp RAF 4d; 260 hp Fiat A-12; 300 hp Renault 12Fe; and 400 hp Sunbeam Matabele. Most of the first Airco production run were powered by the 250 hp Rolls-Royce. Generally Rolls-Royce engines were preferred. However, lack of supply meant alternative engines were needed. Performance figures are given in table 93.

- Sir Gordon Taylor [139, pp 157–159] discusses the difficulty in escorting the D.H.4 with the Sopwith Pup in December 1917. Even when carrying a bomb-load the D.H.4 was faster than the Pup.
- JM Bruce [59, p 52] discusses the production problems of Rolls-Royce Eagle and Falcon. This was apparently because officialdom in 1916 prevented the Rolls-Royce company from equipping a new factory, refused the company permission to build a special repair shop and in July 1917 declined a Rolls-Royce proposal that would have provided 2,000 Eagle engines between June 1918 and February 1919.
- Hooton [104, p 286], in footnote 89, states that British cameras by the summer of 1916 had 18-plate automatically reloading magazines for photographic reconnaissance.

Table 92: Airco de Havilland D.H.2 performance figures. The main sources are JM Bruce [30, 41, 43, 59] and [1]. Wing span: 28 ft 3 in; wing area: 249 ft².

Aircraft	100 hp	110 hp
Engine	Gnome	Le Rhône
	Monosoupape	
Weights (lb):		
Empty	943	1004
Military load	80	80
Pilot	180	180
Fuel and oil	238	283
Loaded	1441	1547
Max speed (mph):		
Sea level	93	92
5000 ft	90	85
6500 ft	86	
7000 ft	85	85
9000 ft	78	82.5
10000 ft	77	
11000 ft	73.5	72
Climb to (m. s.)/ rate (ft p s):		
1000 ft	1 10	
2000 ft	2 30	
3000 ft	4 30	4 35
4000 ft	6 10	
5000 ft	8 25	
6000 ft	11 00	12 00
6500 ft	12 00 / 340	
7000 ft	14 00	
8000 ft	17 00	
9000 ft	20 30	23 30
10000 ft	24 45 / 285	31 00
10700 ft		46 00
11000 ft	31 30	
11700 ft	45 00	
Service Ceiling (ft)	14000	
Endurance (hrs)	2.75	3

- Finnegan [76, pp 337–338] discusses the camera types used by the allies for photographic reconnaissance, the British D.H.4s used the L, LB, BM and P type cameras all with multi-plate magazines and semi-automatic plate changes [76, pp 289–291].
- Oliver Stewart [15, pp 104–105] discusses the rumoured performance of the D.H.4 as having a superiority of performance and altitude over German fighters, the reality was it often had to fight its way to and from its objectives.
- CPO Bartlett [6, p 58] (early June 1917) reports that the early D.H.4 with 250 hp Rolls-Royce Eagle VI had a top speed around 110 knots and had difficulty exceeding 15,000 ft with bomb load. CPO Bartlett [6, p 72] reports meeting with 55 Squadron RFC pilots who also flew the D.H.4 and their aircraft apparently had better performance as they crossed the line at 15,000 ft and bombed at 16–17,000 ft as opposed to the RNAS aircraft bombing at 11–12,000 ft. CPO Bartlett [6, p 77] (9th September 1917) reports on a test comparison of a D.H.4 with a Bristol F2B, the D.H.4 being slightly faster but was outmanoeuvred and it was reported that the F2B could dive at 200 mph. CPO Bartlett [6, p 84] (29th September 1917) reports diving ‘nearly vertically’ from 15,000 ft to 12,000 ft in around 18s and reaching about 180 mph. CPO Bartlett [6, p 92] reports on a RFC 375 hp Rolls-Royce D.H.4 (24th October 1917) as being very fast and having an extraordinary climb, on page 58 this model is given as having a top speed of around 130 knots and a ceiling of 22,000 ft.
- Harold Porter [127, p 334] considers the Americanised version of the D.H.4 to have been ‘glaringly unfitted for use as combat planes, and only fair for observation purposes’.

Table 93: Aircro de Havilland D.H.4 performance figures. The main source is JM Bruce [30, 34, 59]. A2129 was an early installation of the Rolls-Royce Mk III. A7446 was the test installation of the Rolls-Royce Eagle VIII. Experimental engine installations include the RAF 3d in A2168, RAF 4d in A7864 and Sunbeam Matabele in A8083. The Galloway Adriatic was tested in A7671, but only comparatively small numbers were powered by this engine. Bomb load: 2×230 lb or 4×112 lb or equivalent of smaller bombs. Wing span $42\text{ ft } 4\frac{5}{8}\text{ in}$; wing area 434 ft^2 .

Report Date Aircraft	M.64 Sep 16 Prototype	M.145 Sep 17 B9458	M.145C Nov 17	N.M.199 Jul 18 D1769 flotation	N.M.199A Aug 18 D1769 flotation hydrovane	M.152A Nov 17 A7671	M.152A Nov 17 A7671	M.152A Nov 17 A7671	M.83 Mar 17 A2129	M.136 Aug 17 A7446	M.92 Apr 17 A2168	M.116A Jul 17 A 7532	A8083
Engine	200 hp BHP	230 hp BHP	Siddeley	230 hp Siddeley Puma	230 hp Siddeley Puma	230 hp Galloway Adriatic	230 hp Galloway Adriatic	230 hp Galloway Adriatic	250 hp Eagle III	375 hp Eagle VIII	230 hp RAF 3d	Fiat 230 lb	Matabele
Bomb load	Nil	Nil	4x 112 lb	Nil	Nil	Nil	Nil	4x 112 lb	Nil	Nil	Nil	2x 230 lb	Nil
Propeller	2328	D.G.1329	A.B.703	A.B.703	A.B.703	D.G.1329	D.G.1329	A.B.7037					
Weights (lb):													
Empty	2010	2197	2197	2396	2209	2209	2209	2209	2303	2387	2304	2306	2468
Military Load	185	185	185	310	559	185	185	559	185	185	166	665	185
Crew	360	360	360	360	360	360	360	360	360	360	360	360	360
Fuel and oil	390	340	492	444	513	513	513	513	465	540	510	501	513
Loaded	2945	3234	3610	3344	3510	3267	3641	3641	3313	3472	3340	3822	3526
Max speed (mph):													
ground level													
3000 ft	117	112	108	94.5	96	110	104.5	110	117	136.5	120	110	122
6500 ft													
9000 ft	113	109	106	91	93	110	104.5	110	113	133.5	118	106.5	118
10000 ft													
12000 ft	107.5	106.5	98	97	87	100.5	100.5	100.5	102.5	130.5	110.5	99	115
13000 ft										126			110.5
15000 ft	105	102								122.5			108
16500 ft													
Climb to (m. s.) / Rate (ft./s):													
1000 ft	0.57	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.05	0.45	1.25	1.40	
2000 ft	2.04	2.55	3.18	3.18	3.18	3.18	3.18	3.18					
3000 ft	3.20	4.36	11.48	11.48	11.48	11.48	11.48	11.48					3.35
4000 ft	6.30	8.05	11.48	11.48	11.48	11.48	11.48	11.48					
5000 ft	8.20	10.00	9.55	9.55	9.55	9.55	9.55	9.55					
6000 ft	9.30 / 625	11.00 / 510	15.30 / 375	10.30	10.30	10.00 / 525	13.10 / 370	8.55 / 550	8.55 / 550	5.09 / 1042	8.00	12.30	
7000 ft	16.20 / 430	19.00 / 370	24.36 / 240	19.40	19.10	17.48 / 380	24.55 / 235	16.25 / 380	16.25 / 380	9.00 / 830	14.15	14.00	7.30
8000 ft	18.40	21.50	18.55 / 365	18.55 / 365	18.55 / 365	18.55 / 365	18.55 / 365	18.55 / 365	18.55 / 365	13.05	13.05	26.40	8.35
9000 ft	21.10	25.00	24.25	24.25	24.25	24.25	24.25	24.25	24.25	18.55	18.55	39.00	
10000 ft	23.50	29.30	37.55 / 190	37.55 / 190	37.55 / 190	37.55 / 190	37.55 / 190	37.55 / 190	37.55 / 190	14.45	25.15	48.05	
12000 ft	26.05	32.30	43.50	43.50	43.50	43.50	43.50	43.50	43.50	16.30	29.20		16.00
13000 ft	29.00 / 310	16000 ft	51.20	51.20	51.20	51.20	51.20	51.20	51.20	18.35	34.30		23.35
14000 ft										20.00	38.00		16.00
15000 ft										20.00	38.00		
16000 ft										20.00	38.00		
16500 ft										20.00	38.00		
Service Ceiling (ft)	4.5	4.5	4.5	3	3	4.5	4.5	4.5	3.5	3.75	4	4.5	21000
Endurance (hrs)													

7.3 Airco D.H.5

The de Havilland D.H.5 was a single-seat fighter (scout) used by the RFC in 1917. In service the D.H.5 tended to be used for ground-attack. The main source used in this summary is JM Bruce [30, 41, 53, 59]. The main engines used were: 100 hp Gnome Monosoupape; 110 hp Le Rhône 9J; and 110 hp Clerget 9Z. Performance figures are given in table 94.

- Michael Molkentin [122, pp 204–6] cites No. 2 Squadron AFC as considering the D.H.5 ‘nimble and easy to fly’, ‘able to be dived at 180 mph without the wings dropping off’. However, it performed badly above 10,000 ft where ‘Germans easily outran the D.H.5’.

7.4 Airco D.H.6

The Airco de Havilland D.H.6 was a two-seat trainer used by the RFC in 1917. However, it was also used for maritime patrols with no weapons as submarines would dive if they saw an approaching aircraft. The main source used in this summary is JM Bruce [59, pp 66–71]. The main engines used were: 90 hp R.A.F. 1a; 90 hp Curtiss OX-5; and 80 hp Renault. Performance figures are given in table 95.

- L W Sutherland [138, p 25] describes the D.H.6 as ‘God’s gift to the trainee’ and the ‘dearest, kindest, most sedate old lady in a first solo’. The nicknames were ‘Clutching Hand’, ‘Flying Coffin’ or ‘Dung Hunter’.

7.5 Airco D.H.9

The D.H.9 was a major RNAS/RFC/RAF day bomber in 1918. The main source used in this summary is JM Bruce [26, 30, 35, 59]. Engines used include (this includes some used post-war): 230 hp Siddeley Puma; 230 hp Galloway Adriatic; 290 hp (high-compression) Siddeley Puma; 260 hp Fiat A-12; 430 hp Napier Lion; 400 hp Liberty 12A; 200 hp Wolseley W.4A Viper; 300 hp Hispano-Suiza 8Fb; 385 hp Armstrong-Siddeley Jaguar III; 500 hp Armstrong-Siddeley Jaguar IVc; 345 hp Armstrong-Siddeley Serval IV; 420 hp Bristol Jupiter VI; 460 hp Bristol Jupiter VII; 300 hp A.D.C. Nimbus; 465 hp Wright Whirlwind R-975. The main engine used during WWI was the Puma, generally regarded as unreliable. The D.H.9 was essentially an extensively modified D.H.4 with a lower-powered and unreliable engine. There were improvements in the design, in particular there was an internal bomb-bay that could accommodate 2×230 lb or 4×112 lb bombs although this appears rarely to have been used: external racks being preferred. The Napier Lion gave a much better performance and reliability, but was not in service with operational units by the Armistice. Performance figures are given in table 96.

- JM Bruce [59, pp 74] states that Geoffrey de Havilland had unofficially told Trenchard that the D.H.9’s performance would be poorer than that of the D.H.4 with the 275 hp Rolls-Royce, and it would be unable to fly in formation at 15,000–16,000 ft with a full bomb load.
- Although the D.H.9 was intended to replace the D.H.4 its performance was so poor that D.H.4 production had to be restarted [59, p 77].

7.6 Airco D.H.9A

The D.H.9A was a major RAF day bomber in 1918. The main source used in this summary is JM Bruce [27] [30, pp 199–204] [59, pp 78–83] and Chaz Bowyer [13]. Gathering concerns about the prospective performance of the Puma engined D.H.9 saw interest in substitution of the Rolls-Royce Eagle VIII by late 1917. This was successful using a similar installation to that used in the D.H.4. With the Rolls-Royce engine in short supply the prospect of the American Liberty 12 engine seemed offer similar performance and saw this investigated then selected as the major engine. The D.H.9A had larger wings than the D.H.9. Initial production problems slowed the introduction of the D.H.9A into service. Engines used include: 375 hp Rolls-Royce Eagle VIII; 400 hp Liberty 12A. The main engines used during WWI was the Liberty 12. Future plans included use of the 500 hp Galloway Atlantic. Performance figures are given in table 97.

7.7 Armstrong Whitworth F.K.3

The Armstrong Whitworth F.K.3 was a minor two-seat reconnaissance, general purpose or training aircraft used particularly mainly Macedonia during 1917–18. The main source used in this summary is JM Bruce [59, pp 93–99]. Engines known to have been used are: 120 hp Beardmore; 90 hp R.A.F.1a. Performance information is given in table 98.

7.8 Armstrong Whitworth F.K.7 and F.K.8

The Armstrong Whitworth F.K.7 (prototype) and F.K.8 (production) was a small scale two-seater Corps reconnaissance-bomber used particularly for Artillery spotting in 1917–18. The main source used in this summary is JM Bruce [59, pp 100–105]. Engines known to have been used are the 160 hp Beardmore. Performance information is given in table 99.

Table 94: Airco de Havilland D.H.5 performance figures. The main sources are JM Bruce [30,41,53,59] and [1]. A5172 was the prototype DH5. For ground attack 4 × 25 lb Cooper bombs could be carried. Wing span 25 ft 8 in; wing area 212.1 ft².

Report	M.76	M.117	A9403	
Date	Dec 16	Jul 17	standard	ply covered
Aircraft	A5172	A9186	fuselage	
Airscrew	L.P.1708		110 hp Le Rhône	
Engine	110 hp Le Rhône	130 hp Le Rhône	No. 100945	
Weights (lb):				
Empty	1006	1010	985	1020
Military Load	80	80	40	25
Pilot	180	180	180	160
Fuel and oil	220	222	225	225
Loaded	1488	1492	1430	1430
Max speed (mph):				
3020 ft	110			
4800 ft	108			
6500 ft	104			
8660 ft	102			
10000 ft	100	102	104	97
10250 ft	100			
12350 ft	98			
13000 ft		94.5		
14100 ft	95			
15000 ft		89		
Climb to (m. s.) / Rate (ft/s):				
1000 ft	1 00	0 50		
2000 ft	2 00			
3000 ft	3 06			
4000 ft	4 18			
5000 ft	5 42		4 55	6 20
6000 ft	7 24			
6500 ft	8 24 / 515	6 55 / 745		
7000 ft	9 24			
8000 ft	11 36			
9000 ft	14 00			
10000 ft	16 18 / 380	12 25 / 540	14 15	18 50
11000 ft	18 48			
12000 ft	22 00	16 40		
13000 ft	27 00			
14000 ft	33 00	22 50		
15000 ft		27 30 / 165		
14300 ft	36 00			
15000 ft		27 30		
Service Ceiling (ft)	14000	16000		
Endurance (hrs)	3	2.75		

Table 95: Airco de Havilland D.H.6 performance figures. The main source is JM Bruce [30, p 190] [59, p 71]. Wing span 35 ft 11.125 in; wing area 436.3 ft².

Report	N.M.239		N.M.239
Date	12 Nov		12 Nov
	1918		1918
Aircraft	DH5		
Engine	R.A.F. 1a	90 hp Curtiss	90 hp Curtiss plus flotation gear
<hr/>			
Weights (lb):			
Empty	1460	1539	1624
Military Load			
Crew	360	180	180
Fuel and oil	207	207	207
Loaded	2027	1926	2011
<hr/>			
Max speed (mph):			
2000 ft		75	72.5
6500 ft	66		
<hr/>			
Climb to (m. s.):			
6500 ft	29 00	35 00	45 00
<hr/>			
Service Ceiling (ft)		6100	5400
<hr/>			
Endurance (hrs)			
<hr/>			

- P E Butcher [64, pp 58-61] flew as an observer in the F.K.8 and describes the aircraft as ‘an easy and stable machine to handle’.

7.9 Avro 504

The Avro 504 was a significant two-seat reconnaissance, trainer or single-seat Home Defence fighter used 1914–18. The main source used in this summary is JM Bruce [59, pp 112–120]. Engines known to have been used are: 80 hp Gnome (504, 504D); 80 hp Le Rhône (504); 80 hp Clerget (504); 100 hp Gnome Monosoupape (504J, 504K); 130 hp Clerget (504K); 110 hp Le Rhône. Performance information is given in table 100.

7.10 Bristol Scout

The Bristol Scout was a single-seat fighter (scout) widely used in the RNAS/RFC in 1914–16. The main source used in this summary is JM Bruce [30, 41, 52]. Although a Bristol Scout was the first British aircraft to go to France equipped with a synchronised machine-gun on 25th March 1916, there was no attempt to standardise on this and only a few were thus equipped. Most had some ad-hoc attempt at armament.

The main engines used were Scout B: 80 hp Gnome; Scout C: 80 hp Gnome, 80 hp Le Rhône; Scout D: 80 hp Le Rhône 9C, 80 hp Gnome, 100 hp Gnome Monosoupape, 100 hp Clerget 9Z. Performance figures are given in table 101.

- Leonard Rochford [130, pp 36 and 41] around August 1916 describes the Bristol Scout ‘the controls were beautifully sensitive and balanced so that it felt as light as a feather’. A Le Rhône powered Bristol Scout is said to appear to give more power than a Clerget powered one.
- Sir Gordon Taylor [140, p 35] in January 1917 describes the Bristol Scout as ‘a delightful little biplane, feather-light on controls and accurate in its reactions’.
- James McCudden [119, pp 140 and 143] in February 1917 describes the Bristol Scout as ‘I liked it so much that I plucked up the courage to do six loops on my first flight’ and ‘a most excellent flying machine, and quite easy to fly and land’.

7.11 Bristol M1

The Bristol M1 was a single-seat fighter (scout) produced in limited numbers in 1917. The M1A was the first prototype, the M1B was a group of four later prototypes and M1C was the main production version. Due to the effects of the prejudice against monoplanes it was used either in the Middle East or in training establishments in the RNAS/RFC/RAF in 1917–18. The main sources used in this summary are JM Bruce [41, 51].

Table 96: Airco D.H.9 performance figures. The main source is JM Bruce [30, 35, 59]. JM Bruce has a further comment that a D.H.9 with Liberty engine is reported to have weighed 4645 lb loaded and to have a maximum speed of 114 mph and that these figures are of doubtful accuracy. Bomb load: 2×230 lb or 4×112 lb or equivalent of smaller bombs. Wing span 42 ft $4\frac{3}{8}$ in; wing area 434 ft².

Test	M.146D	M.156A	M.156B	M.171A	M.205A	M.205B	E.2313A
Date	Nov 17	Nov 17	Nov 17	Feb 18	Nov 18	Nov 18	Aug 18
Aircraft	A7559	C6051		C6052			C6078
Engine	BHP	Siddeley Puma		Fiat	High-compression		Lion
	Galloway	No 5019/W.D. 22693			Puma		
Bomb load	Nil	2×	3×	Nil	Nil	2×	Nil
		230 lb	112 lb			112 lb	
Airscrew	D.G.1329	D.G.2627	D.G.2627	D.G.B.2627	A.B.7931	A.B.7931	
Weights (lb):							
Empty	2193	2203	2203	2460	2232	2232	2602
Military Load	185	571	487	185	185	361	185
Crew	360	360	360	360	360	360	360
Fuel and oil	545	535	535	595	550	550	578
Loaded	3283	3669	3585	3600	3327	3503	3725
Max speed (mph):							
Ground level							144
6500 ft	116						
10000 ft	110.5	111.5	104.5	117.5	116	114	138
13000 ft	106	104.5					135.6
15000 ft	102	97.5	95.5	107.5	106	103	134
16500 ft		91					
Climb to (m. s.) /							
Rate (ft/s):							
1000 ft	1 25	1 25					0 36
2000 ft	2 55						1 12
5000 ft		8 00					3 10
6000 ft	10 05						3 55
6500 ft	11 05 / 465	11 00 / 465	12 30 / 400	9 00	7 50 / 675	9 30 / 560	4 55
8000 ft		8 40	14 35				5 25
10000 ft	19 55 / 330	20 05 / 320	23 20 / 260	16 00	13 55 / 495	16 35 / 405	7 10
13000 ft		31 55					10 05
14000 ft	36 10						11 40
15000 ft	42 25 / 140	45 00 / 115	62 00 / 55	32 20	28 00 / 240	34 25 / 185	13 05
16000 ft	50 50						14 35
16700 ft		67 50					
Service Ceiling (ft)	16000	15500	14000	17500	17000	17000	24000
Endurance (hrs)	4.5	4.5					3.5

Table 97: Airco D.H.9A performance figures carrying two 230 lb bombs. The main source is JM Bruce [30, p 204], [59, pp 78–83]. C6350 is the prototype Eagle powered D.H.9A tested in February 1918. C6122 was the first Liberty powered D.H.9A tested at Martlesham Heath in May 1918. B7664 was a trial combination of a production D.H.9A airframe with a Eagle VIII when supplies of Liberty engines ceased (temporarily) in July 1918. Bomb load of up to 600 lb. Wing span: 45 ft 10.625 in; wing area: 486.73 ft².

Report Date	M.182		M.213		M.213A	M.227
Aircraft	C6350		C6122		B7664	
Engine	Eagle VIII		Liberty		Eagle VIII	
Bomb load	Nil	2 × 230 lb	2 × 230 lb	Nil	2 × 230 lb	2 × 230 lb
Airscrew	D.G.2160		X.3012M		A.M.2610	
Weights (lb):						
Empty	2705	2705	2705	2770	2800	2832
Military load	185	608	1200	185	580	581
Crew	360	360	360	360	360	360
Fuel and oil	550	550	550	905	905	960
Loaded	3800	4223	4185	4220	4645	4733
Max speed (mph):						
Ground level				123		
10000 ft	125.5	118	110.5	120	114.5	111.5
11000 ft				116.5	110	
15000 ft	116	104.5		114	106	
16500 ft				112	102	
Climb to (m. s.) / Rate (ft/s):						
2000 ft				1 50	2 20	
5000 ft				5 00	6 25	
6500 ft	7 00 / 770	8 40 / 600	11 00 / 450	6 50 / 800	8 55 / 595	13 24 / 380
10000 ft	12 10 / 600	15 35 / 420	20 35 / 285	11 50 / 605	15 45 / 475	24 36 / 265
13000 ft				17 36 / 440	24 18 / 280	
15000 ft	22 55 / 555	33 40 / 170		22 50 / 330	33 00 / 185	
16500 ft				28 00 / 245	43 50 / 110	
Service Ceiling (ft)	20000	16000	14000	19000	16500	14500
Endurance (hrs)	4.5		3.5	5.75	5.25	

- JM Bruce [51, pp 6–7] cites Oliver Stewart [15, pp 81–83] about the Bristol Monoplane that ‘although it came out much earlier than the S.E. or the Snipe, was actually superior to both of them in all-round performance and powers of manoeuvre’.

The main engines used were M1A: 110 hp Clerget 9Z; M1B: 110 hp Clerget; 130 hp Clerget 9B; 150 hp AR1; M1C: 110 hp Le Rhône 9J. Performance figures are given in table 102.

7.12 Bristol Fighter

The Bristol Fighter (F2A and more the F2B) was a major RFC/RAF two-seat fighter-reconnaissance aircraft in the period 1917–18. The main sources used for this summary is JM Bruce [16, 33, 41, 59]. The main engines used include: 190 hp Rolls-Royce Falcon I, 220 hp Rolls-Royce Falcon II; 275 hp Rolls-Royce Falcon III but other engines were used in varying numbers of aircraft. The majority of aircraft had the Falcon III, but other engines were investigated. In particular, it was intended to use the Falcon III for fighter-reconnaissance squadrons and alternative engines for corps squadrons. Performance figures are given in table 103.

According to Hooton [104, p 261] around ten squadrons received the new radio telephone equipment between May and August 1918. This began with Bristol Fighter squadrons, then extending to three of II Brigade’s corps squadrons followed by a bomber squadron.

- Vivian Voss [145, pp 237–242] describes the usage of radio telephones on Bristol Fighters of 88 Squadron in August 1918. Flight commanders had receive/transmit sets, while the other pilots had only receive sets. Aerials were wound in if action was likely, apparently usually when the aircraft had reached their operational height. Vivian Voss [145, pp 242–243] discusses an offensive patrol in which the flight reached

Table 98: Armstrong Whitworth F.K.3 performance figures. The main sources are JM Bruce [30, p 14] [59, p 99] and [1]. Wing span: 40 ft 0.625 in (standard); wing area: 442 ft².

Report			M.40	M.47
Date			May 16	Jun 16
Engine	120 hp		90 hp	105 hp
	Beardmore		R.A.F.1a	R.A.F.1b
	Standard	5528	5552	5519
	F.K.3	long wings		
Airscrew			T.7448	T.7448
Weights (lb):				
Empty	1682		1386	1375
Military load	105		80	80
Crew	320		360	320
Fuel and oil	340		230	235
Loaded	2447		2056	2010
Max speed (mph):				
Ground level	84	90.7	87	92.8
1000 ft			85	
6500 ft				88
8000 ft	83.5	83.5	81	
10000 ft				80
Climb to (m. s.) /				
Rate (ft/s):				
1000 ft			3 00	
2000 ft			7 00	
3000 ft			10 30	
4000 ft			14 00	
5000 ft	13 30	13 30	19 00	8 05
6000 ft			24 00	
6500 ft	19 00		26 30 / 200	12 00 / 380
7000 ft			29 00	
8000 ft			36 00	
9000 ft			41 00	
10000 ft	35 00	35 00	48 56 / 143	23 30 / 210
11000 ft			66 00	
12000 ft			74 00	
12300 ft			78 00	
Service Ceiling (ft)	12000	12000	12000	13000
Endurance (hrs)	3	3	3	2.5

Table 99: Armstrong Whitworth F.K.7 and F.K.8 performance figures. The main sources are JM Bruce [30, p 20] [59, p 105] and [1]. For ground attack 8×25 lb Cooper bombs could be carried. Wing span: 43 ft 3 in; wing area: 540 ft².

Report	M.32	M.46	M.103	M.89
Date	May 16	May 16	May 17	Apr 17
Engine	120 hp Beardmore	160 hp Beardmore	150 hp R.A.F. 4a	150 hp Lorraine- Dietrich
Aircrew	L.P.920		B.&C. 3120	L.P.3020
Weights (lb):				
Empty	1682	1916	1980	1936
Military load	105	133	185	185
Crew	320	360	360	360
Fuel and oil	340	402	302	335
Loaded	2447	2811	2827	2816
Max speed (mph):				
Sea level		98.4		
2000 ft		97		
3000 ft				92
4000 ft		98		
5000 ft		97		
6000 ft		96		
6500 ft		95	94	89
8000 ft	83.5	93		
10000 ft		88	88.5	83
12000 ft		88		
Climb to (m. s.) / Rate (ft/s):				
1000 ft		1 45	1 55	1 55
2000 ft		3 50		
3000 ft		6 00		
4000 ft		8 10		
5000 ft		11 00		
6000 ft		13 55		
6500 ft	19 00 / 280	15 25 / 330	16 25 / 290	16 30 / 280
7000 ft		17 00		
8000 ft		20 05		
9000 ft		23 49		
10000 ft	35 00 / 180	27 50 / 240	32 00 / 175	33 15 / 150
11000 ft		32 20		40 55
12000 ft		39 00	46 25	
13000 ft		49 00	57 10	
Service Ceiling (ft)	12000	13000	12000	11000
Endurance (hrs)	3	3	3	4

Table 100: Avro 504 performance figures. The main source is JM Bruce [30, p 52] [59, p 120]. Wing span: 36 ft; wing area: 330 ft².

Test Date	504	504A	504K	504K	M.268 Oct 17 504K 110 hp	M.268A 504K 110 hp
Aircraft Engine		Le Rhône	Monosoupape	Le Rhône	Le Rhône	Le Rhône
Weights (lb):						
Empty	924	1050	1100	1231	1295	1295
Military load			90	Nil	Nil	Nil
Crew	360		360	360	360	360
Fuel and oil			250	238	200	198
Loaded	1574	1700	1800	1829	1855	1853
Max speed (mph):						
Sea level	82			95		
6500 ft		62	82 79.3	87		
8000 ft				87		
10000 ft				85	75	80
Climb to (m. s.):						
3500 ft		9 30		5 00		
6500 ft		25 00			14 00 / 345	12 30 / 395
8000 ft				8 00		
10000 ft				16 00	27 24 / 185	23 36 / 255
Service Ceiling (ft)			13000	16000	11900	13900
Endurance (hrs)		4.5	3			

a patrol altitude of 21,000 ft and in a dive were claimed to reach possibly 300 mph, although this claim seems higher than generally accepted.

- Arch Whitehouse [147, pp 190–2 & 244] records that 22 Squadron, after being re-equipped with Bristol Fighters in the summer of 1917, crossed the lines at up to 18,000 ft. During the winter after Cambrai all patrols were made at about 18,000 ft and on occasions at 22,000 ft. Arch Whitehouse [147, p 226] describes modifications for tactical support: holes in the floor of the observer’s cockpit for cameras plus bomb racks for ground attack.
- L W Sutherland [138, p 17] describes the Bristol Fighter as having ‘a good turn of speed, good manoeuvrability, and could carry a good load’. They are also describes as being ‘entirely devoid of tricks’.
- Michael Molkentin [122, p 110] cites the German commander Kress von Kressenstein as saying ‘appearance of a new type of machine which is far superior to our one-seater’ and has another quote (probably Australian Major Richard Williams) that ‘the arrival of the Bristol Fighter was the turning point of their fortune in the air in Palestine’. Michael Molkentin [122, p 139] cites one unnamed German officer as describing the Bristol Fighter as ‘an exceptionally fine machine’ that ‘nearly always flying in twos . . . present an extraordinary fighting force, and their harassing of our activities becomes more and more felt’.

7.13 Fairey Campania

The Fairey Campania seaplane was a two-seat floatplane initially for use on the HMS Campania and were used in small numbers by the RNAS. There were a number of versions known by different works numbers. The main source used in this summary is JM Bruce [30, pp 219–222]. Engines known to have been used include F.16: 284 hp Rolls Royce Eagle IV; F.17: 322 hp Rolls Royce Eagle V; F.22: 250 hp Sunbeam Maori II; some late production units had 345 hp Rolls Royce Eagle VIII. Performance figures are given in table 104.

7.14 Fairey Hamble Baby Seaplanes

The Fairey Hamble Baby seaplane was a single-seat floatplane derived from the Sopwith Baby and were used in considerable numbers by the RNAS. One major distinction was the modified wings which incorporated the Fairey Patent Camber Gear which were hinged flaps that could be used to provide ailerons, but also used to increase lift. This enabled a useful load to be carried. The main source used in this summary is JM Bruce [30, pp 223–225]. Engines known to have been used include: 110 hp Clerget; and 130 hp Clerget. Performance figures are given in table 105.

Table 101: Bristol Scout performance figures. The main sources are JM Bruce [30,41,52] and [1]. Wing span: 24 ft 7 in; wing area: 198 ft² (presumably Scout D).

Report Date	Scout A	M.55 Jun 16 Scout C	Scout D	Scout D	Mar 16 Scout D	Scout D	M.21 May 16 Scout D
Aircraft	80 hp Gnome	80 hp Le Rhône P3001	Le Rhône	Le Rhône	80 hp Clerget	110 hp Clerget	110 hp Clerget P 3010
Engine							
Airscrew							
<hr/>							
Weights (lb):							
Empty	617	757	760	766	750	941	926
Military Load		80	60	80	0	80	73
Pilot		180	180	180	170	180	160
Fuel and oil		178	200	169	169	241	256
Loaded	957	1195	1250	1195	1089	1442	1415
<hr/>							
Max speed (mph):							
Ground level	95	92.7	100	92.7	93.8	107.3	
1000 ft		92.5					
3000 ft		91					
5000 ft		90.5	94	90.5		100.8	
6500 ft		89					108
7000 ft		88					
8000 ft					70		
9000 ft		86					
10000 ft		86.5	86	86.5			
11000 ft		87					
<hr/>							
Climb to (m. s.) / Rate (ft/s):							
1000 ft	1 15	0 55		0 55	1 38	1 00	
2000 ft		2 05					
3000 ft		3 35					
4000 ft		5 20					
5000 ft		7 00		7 00	8 05	6 30	
6000 ft		9 30					
6500 ft		10 50 / 385			11 30 / 430		9 30 / 485
7000 ft		12 10					
8000 ft		14 55					
9000 ft		18 00	18 30				
10000 ft		21 20 / 300		21 20	27 30 / 160	18 15	18 20 / 320
11000 ft		25 05					
12000 ft		29 30					
13000 ft		33 00					
14000 ft		41 30					
15000 ft		50 00 / 115		50 00			
<hr/>							
Service Ceiling (ft)		15500		15500	11000	14000	14000
<hr/>							
Endurance (hrs)	3	2.5		2.5	2	2.5	2.5

Table 102: Bristol M1 performance figures. The main sources are JM Bruce [30,41,51] and [1]. The latter says that the official performance report on C4902 contained this note: ‘The figures given above for the speed trials are probably 5 mph too low, as they were obtained from the readings of the air-speed indicator corrected for density only’. The speed in column five is thought to be at ground level. Wing span 30 ft 9 in; wing area 145 ft².

Report	M.161	M.21	M.87	M.149	M.161	
Date	Dec	Jul	Mar	Oct	Dec	
	1917	1917	1917	1917	1917	
Aircraft	M.1C	M.1A	M.1B	M.1C	M.1C	M.1D
			A5142	C4902	C4908	
Engine		110 hp	150 hp	110 hp	110 hp	
	Le Rhône	Clerget	A.R.1	Le Rhône	Le Rhône	Lucifer
Airscrew	P.3017	P.3017		P.3017	P.3017	
Weights (lb):						
Empty	896	913	930	900	896	
Military load	80	50	80	80	80	
Pilot	180	180	180	180	180	
Fuel and oil	192	183	180	180	192	
Loaded	1348	1326	1370	1340	1348	1300
Max speed (mph):						
Ground level	130					125
5000 ft	127					
5400 ft		128				
6500 ft		127	115.5			
7300 ft		125.5				
9300 ft		120				
10000 ft	111.5	118	110	106	111.5	
11200 ft		115.5				
13100 ft		112.5				
15000 ft	104	110.5	100	99.5	104	
Climb to (m. s.) /						
Rate (ft/s):						
1000 ft	0 40	0 35				
2000 ft		1 10				
3000 ft		1 55				
4000 ft		2 40				
5000 ft		3 25				
6000 ft	5 10	4 25				
6500 ft		4 50 / 1080	5 50 / 830	5 50 / 875	5 30 / 885	
7000 ft		5 15				
8000 ft		6 20				
9000 ft		7 20				
10000 ft	10 25	8 30 / 830	11 05 / 525	10 25 / 640	10 10 / 670	
11000 ft		9 50				
12000 ft		11 10				
13000 ft		12 55				
14000 ft		14 55				
15000 ft	19 50	17 25 / 320	27 40 / 150	20 40 / 370	19 50 / 395	
15600 ft		19 40				
16000 ft	23 35					
18000 ft	30 55					
20000 ft	41 35					
Service Ceiling (ft)	20000	17000	15500	21000	20000	22000
Endurance (hrs)	1.75	2.75	1.75	1.75	1.75	1.75

Table 103: Bristol Fighter F2A/F2B performance figures. The main sources are JM Bruce [30, 33, 41, 59]. A3303 and A3304 are the two prototype F2A, there were 50 production models based on A3303. A3304 later incorporated the modifications for the F2B. A7183 had the first Falcon III installation. For ground attack 12 × 25 lb Cooper bombs could be carried. Wing span 39 ft 3 in; Wing area 389 ft².

Test Date	M.69 Oct 16	M.78 Dec 16	A.7 Nov 17	M.128A Aug 17	M.168 Jan 18	M.186 Mar 18	M.178 Feb 18	M.230 Sep 18	M.237 Oct 18	M.249A Feb 19	M.249 Feb 19	M.163 Dec 17		
Aircraft	A3303	A3304	C4808	A7183	B1201	B1204	B1206	C4654	B1200	E2400	E2400	B1181	X8-1A	X8-1A
Engine	Falcon I	150 hp H-S	Falcon II	Falcon III	200 hp H-S	200 hp Arab	230 hp Puma	290 hp HC Puma	Viper	300 hp H-S	300 hp H-S	275 hp Falcon III	300 hp Wright H	350 hp Packard
Airscrew					P.3046	A.B.8201	DC.2627	A.B.7931	A.B.6625	A.B.8831	P.3071	P.3040		
Weights (lb):														
Empty	1727	1474		1934	1733	1886	1918	1944	1867	2067	2067	1958	2010	
Military Load	180	160		185	192	185	185	185	185	185	185	185	283	
Crew	360	360		360	360	360	360	360	360	360	360	360	360	
Fuel and oil	406	479		300	345	373	347	344	394	408	408	347	341	
Loaded	2753	2473	2860	2779	2630	2804	2810	2833	2806	3020	3020	2848	2994	3983
Max speed (mph):														
Ground level	110			123									124	
4000 ft	109	99.5		121.5										
5000 ft	106			119										
6500 ft	105	99		118										
7000 ft	104			115										
9000 ft	102			113										
10000 ft	101	95	111.5	113	105	104	104	110	95	107	108	113	118.5	
11000 ft	100		110.5	111.5		98	104	109		104	108			
12000 ft			109.5	110			101.5	106.5	89	104		108		
13000 ft	96	92	108	108	100.5			103.5						
14000 ft			106.5	105		94	99			101	100.5	105	112	
15000 ft			103.5	102										
16500 ft	96													
Climb to (m. s.) / Rate (ft/s):														
1000 ft	0.50	1.20		0.50	1.10	1.00	1.00	1.00					0.50	
2000 ft	1.55	2.35	2.00	1.45	2.20	2.10	2.05	1.55					1.54	
3000 ft	3.00	4.10		2.45	3.35	3.20	3.10						2.45	
4000 ft	4.10	5.50		3.45	5.00	4.45	4.25						3.50	
5000 ft	5.25	7.30		4.50	6.25	5.55	5.40	5.05					4.55	
6000 ft	6.50	9.25	6.50	5.55	7.50	7.20	7.00						6.05	
6500 ft	7.30	10.30 / 430		6.30	8.40 / 620	8.05 / 650	7.40 / 710	7.00 / 790	12.20 / 420	7.10 / 755	7.18 / 740	6.48 / 785	7.50	
7000 ft	8.15	11.30		7.05	9.30	8.55	8.25					7.20		
8000 ft	10.00	13.55	9.50	8.25	11.10	10.30	9.55					8.45		
9000 ft	12.00	16.10		9.45	13.05	12.25	11.35					10.15		
10000 ft	14.30	19.00 / 350	13.15	11.15	15.05 / 475	14.25 / 470	13.30 / 550	11.55 / 620	22.20 / 280	12.20 / 560	12.48 / 540	11.50 / 405	13.20	15.20
11000 ft	17.00	22.00		12.55	17.15	16.40	15.15					13.40		
12000 ft	19.25	23.30	17.35	14.30	19.40	19.10	17.20					15.40		
13000 ft	22.05	29.25		16.40	22.20	22.05 / 320	19.35		36.20			18.00 / 405		
14000 ft	27.00	34.00	23.15	18.50	25.20	25.35	22.15					20.40		
15000 ft	31.00			21.20	28.50 / 270	29.45 / 215	22.10 / 320	22.10 / 380		24.50 / 280	25.36 / 260	23.45 / 290	24.00	
16500 ft					38.18 / 135									
Service Ceiling (ft)	16000	14500	20000	20000	19000	17000	20000	20500	14500	18250	18000	18000	20900	
Endurance (hrs)	3.25	6	3	3										2.75

Table 104: Fairey Campania Seaplane performance figures. The main source used here is JM Bruce [30, pp 221–222]. Wing span: (upper) 61 ft 7.5 in; Wing area F.16: 639.8 ft², F.17 and F.22 627.8 ft².

Aircraft	F.16				F.17				
Flight Condition	“A” load	“B” load	“C” load	“D” load	Fuel 4.5 hrs	Fuel 5 hrs	Fuel 6.75 hrs		
Test Date	Jul 17	Jul 17	Jul 17	Jul 17	June 17	Oct 17	Jul 17	Oct 17	
Engine	250 hp Rolls-Royce Mk.IV				275 hp Rolls-Royce Mk.I				
								Maori Mk.II	Jan 18
								Eagle VIII	Rolls-Royce
Weights (lb):									
Empty	3725	3725	3725	3725	3713	3713	3680	3672	3874
Military load	20	80	165	699	650	650	613	666	641
Pilot	180	360	360	360	360	360	360	360	360
Fuel and Oil	241	515	1002	1002	783	807	1053	631	782
Loaded	4166	4680	5252	5786	5506	5530	5706	5329	5657
Max speed (mph):									
sea level					90			85	
2000 ft	82	82.5	80	62	87.5	78	80	84.5	80.5
6500 ft	75	74	75.5		82.5		76	78	64
Climb to (m. s.) /									
Rate (ft/s):									
2000 ft	3 20 / 578	4 20 / 420	5 20 / 320	8 50 / 200	5 30 / 307	5 35 / 302	6 00	7 00 / 246	6 05 / 265
6500 ft	13 40 / 330	19 20 / 220	27 05 / 130	/ 20	28 30 / 125	34 15	31 30	38 00 / 80	41 30
Service Ceiling (ft)	10700	9000	7300	4500	7100	6000	6900	6000	5500
Endurance (hrs)	1.5	3.25	6.5	6.5	4.5	5	6.75	4.5	3

Table 105: Fairey Hamble Baby Seaplane performance figures. The main source used here is JM Bruce [30, pp 225]. Wing span: 27 ft 9.25 in; Wing area 246 ft². Bomb load: 2 × 65 lb bombs.

Test Date	May 17
Aircraft	
Engine	110 hp Clerget
Propellor	A.D.555
Weights (lb):	
Empty	1386
Military load	185
Pilot	180
Fuel and Oil	195
Loaded	1946
Max speed (mph):	
2000 ft	90
6500 ft	90
Climb to (m. s.):	
2000 ft	5 30 / 340
6500 ft	25 00 / 150
Service Ceiling (ft)	7600
Endurance (hrs)	2

7.15 Felixstowe Flying Boats

The Felixstowe F.2A and F.3 were flying boat used in 1917–18 by the RNAS and RAF. The Felixstowe F.1 was essentially the wings and tail unit of the Curtiss H.4 ‘Small America’ mated with a hull designed by Squadron Commander John C Porte. The F.2 was a similar approach with the wings and tail of the Curtiss H.12 ‘Large America’. The F.3 was a development of the F.2. The main sources used are JWR Taylor [139, pp 362–95] and JM Bruce [24]. Engines known to have been used include: two 345 hp Rolls-Royce Eagle VIII (F.2A); two 275 hp Rolls-Royce; two 320 hp Sunbeam Cossack. Performance figures are given in table 106.

- Squadron Leader Hallam [93, pp 183–214] compares the Felixstowe flying boats with German seaplanes. Not surprisingly the flying boats have greater endurance and lifting capacity for anti-submarine work. The seaplanes have greater speed and manoeuvrability.

7.16 Handley Page O/100 and O/400

The Handley Page O/400 was a successor to the RNAS Handley Page O/100 as a four-seat heavy night bomber used by the RNAS and RAF in 1918. The concept of a heavy night bomber was not popular with General Trenchard, but the success of both the RNAS night bombing program and that of the Germans caused more general acceptance. The main sources used in this summary are JM Bruce [19] and [59, pp 261–268]. The main engines used include: 2 × 375 hp Rolls-Royce Eagle VIII; 2 × 284 hp Rolls-Royce Eagle IV; 2 × 275 hp Sunbeam Maoris; later 2 × 350 hp Liberty 12-N. Performance figures are given in table 107.

- Paul Bewsher [8, p 70] reports a O/100 at 7,500 ft and climbing with a indicated air speed of 50 mph. Paul Bewsher [8, p 155–156] reports intending to cross the lines at 5,500 ft with the intention of arriving at Bruges at 9,000 ft.
- AR Kingsford [111, pp 197–198] states that when 100 Squadron converted to the Handley-Page with 2 × 375 hp Rolls-Royce engines they found the aircraft to be heavy on controls and could typically lift 16 × 112 lb bombs.

7.17 Martinsyde S.1

The Martinsyde S.1 was a single-seat fighters (scout) used by the RFC in 1914–15. The main source used in this summary is JM Bruce [41, 59]. The main engines used: 80 hp Gnome. Performance figures are given in table 108.

7.18 Martinsyde G.100 and G.102

The Martinsyde G.100 and G.102 were single-seat fighters (scout) used by the RFC in 1916–17. They were relatively large and seems to have been intended as an escort. In service it was not successful as a fighter, but was widely used as a single-seat bomber. It was known in the RFC as the Martinsyde Elephant. The main

Table 106: Felixstowe F.2A and F.3 performance figures. The main sources are JWR Taylor [139, pp 363 and 365] and JM Bruce [24] [30, pp 246 and 249].

Report Date	N.M.125			N.M.155			
	Mar 18	Jun 17	Feb 17	Apr 18	Apr 18	Apr 18	May 18
Aircraft	F.2A	F.2C	F.3	F.3			
Engines	2× R-R Eagle VIII	2× R-R Eagle V	2× 320 hp Sunbeam Cossack	2× 345 hp R-R Eagle VIII			
Airscrew Load	A.B.665	A.B.665	A.B.586	A.B.665			
				Light	Medium	Normal	Overload
Weights (lb):							
Empty	7549	6768	8270	7958	7958	7958	7928
Military Load	585	402	Nil	238	1317	1461	1461
Crew	720	720	900	720	720	720	720
Fuel and oil	2124	2350	2455	836	2089	2096	3142
Loaded	10978	10240	11625	9752	11084	12235	13281
Max speed (mph):							
400 ft			88.5				
2000 ft	95.5	98		93	92.5	91	90
6500 ft	88.5	94		91.5		86	87
10000 ft	80.5	91		87.5			
Climb to (m. s.) / Rate (ft/s):							
2000 ft	3 50 / 470	4 50 / 425	3 00	3 10 / 580	4 06 / 436	5 25 / 337	7 50 / 230
6500 ft	16 40 / 282	18 20 / 250	27 00	12 55 / 378	18 12 / 240	24 00 / 165	41 30 / 74
10000 ft	39 30 / 82	38 00 / 113	60 00	24 50 / 218	41 30 / 90		
Service Ceiling (ft)	9600	10300		12500	9700	8200	5700
Endurance (hrs)	6			2.5	6	6	9.5

source used in this summary is JM Bruce [41, 54]. The main engines used: 120 hp Beardmore (G.100); 160 hp Beardmore (G.102); and experiment 200 hp Sunbeam Arab. Performance figures are given in table 109.

- James McCudden [119, pp 145–146] states that flying an unloaded Martinsyde in early 1917 he climbed to 10,000 ft in about 20 minutes; to 18,000 ft in about an hour. The ceiling was 18,500 ft. The model is not clear, but on page 143 he refers to a 120 hp Beardmore, suggesting G.100, referring to the machine as very comfortable and warm..
- L W Sutherland [138, p 19] describes the 160 hp Martinsyde (G.102) as ‘sluggish, “sloppy” on controls and altogether a horrible machine in which to fight for your life’. They were describes as carrying a good load.

7.19 Martinsyde F.3 and F.4

The Martinsyde F.3 and the production version F.4 Buzzard was a single-seat fighter (scout) that was close to entering service with the RAF and Aviation Militaire at the Armistice. Around four dozen aircraft had been delivered at the time of the Armistice, but none had reached the Western Front.

The F.3 had been planned around the Rolls-Royce Falcon. JM Bruce [59, p 284] says the the F.3 proved itself superior in manoeuvre and performance to all the contemporary types of single-seat fighters it was matched with in mock combat. Four F.3 were supplied to Home Defence squadrons. Oliver Stewart’s comments [15, pp 77–78] suggest that the manoeuvrability was less than that of the usual single-seat fighters. By mid-August 1918 forty-four production F.3s had been completed, but were lying engineless in store. Lack of supply of the Falcon was one factor in re-design to use the 300 hp Hispano-Suiza (though regarded as an alternative engine for the F.3) as the F.4 in early 1918. Even so, supplies of the 300 hp Hispano-Suiza were slow. Around four dozen F.4 were delivered by the end of October 1918, but had not entered service. There was also a planned F.4 Mark 1a long-range escort version. The main sources used in this summary are JM Bruce [41, 59].

The main engines used were 300 hp Hispano-Suiza 8Fb, 200 hp Lorraine-Dietrich 8Bb and 275 hp Rolls-Royce Falcon III. Performance figures are given in table 110.

7.20 Royal Aircraft Factory B.E.2a–g

The B.E.2 family was a widely used group of aircraft for a number of roles, including two-seat reconnaissance, artillery-observation, single-seat bomber, Home Defence fighter or two-seat trainer in 1915–17 for the RFC.

Table 107: Handley Page O/100 and O/400 performance figures. The main source are JM Bruce [19], [30, p 277], [59, p 268] and [1]. The O/400 could carry up to 2000 lb of bombs. Wing span: 100 ft; wing area 1,648 ft².

Report	M.143	M.143A	M.159	M.202	M.219
Date	Sep 17	Sep 17	Nov 17	May 18	Jul 18
Aircraft	O/100	Prototype O/400	O/400	O/400	O/400
Engine	Eagle VI	Fiat	Maori	Eagle VIII	Eagle VIII
Bomb load	Nil	16 × 112 lb	Nil	1500 lb	16 × 112 lb
Airscrew	A.B.664	A.B.7821	A.B.6934		A.B.694
Weights (lb):					
Empty	8480	8480	8326	8326	8200
Military load	200	1992	200	100	1600
Crew	720	720	720	540	540
Fuel and oil	2830	2830	1204	1204	2496
Loaded	14000	14022	9961	10170	14000
					14300
					13360
Max speed (mph):					
Sea level	95		97.5	92	97.5
4000 ft			86.5		
5000 ft			83.5		90
6500 ft			88.5	87	
8000 ft			85	75	84.5
10000 ft			80	82	80
Climb to (m. s.) /					
Rate (f/s):					
1000 ft	2 10	2 10	2 55		
2000 ft		4 35	6 20		
4000 ft		10 30	14 40		
5000 ft					12 00
6000 ft		18 00	26 35		
6500 ft		20 20 / 215	30 30 / 120	24 25 / 190	27 10
7000 ft			34 53	19 50 / 240	48 00 / 85
8000 ft		28 10	46 05		18 00
9000 ft		34 40			
10000 ft		42 35 / 111		53 30 / 65	45 00
				40 00 / 125	32 00
Service Ceiling (ft)	10500	7000	9000	10500	5500
					8500
Endurance (hrs)	8	8			8
					10000
					8500

Table 108: Martinsyde S.1 performance figures. The main source used here is JM Bruce [41, p 146] [59, p 276]. Wing span: 27 ft 8 in; wing area: 280 ft².

Aircraft	
Max speed (mph):	
Sea level	87
Service Ceiling (ft)	
Endurance (hrs)	

Table 109: Martinsyde G.100 and G.102 performance figures. The main source is JM Bruce [30,41,54]. Aircraft 4735 is the G.100 prototype. A3997 is shown with tests using a German radiator in the centre section, the normal radiator is in use. The first column has the wing radiator disconnected, the second it is faired over with plywood. Bomb load: 1 × 336 lb or 1 × 230 lb or 2 × 112 lb or 4 × 65 lb or up to 12 × 20 lb Cooper bombs. Wing span 38 ft; wing area 430 ft².

Report	M.80				M.130		
Date	Jan 17				Aug 17		
Aircraft	G.102	4735	G.100	G.102	A6299	A3997	
Engine	160 hp	G.100	Production	Standard	Eeman gun	in use	German radiator
Airscrew	L.P.2400	120 hp	Beardmore		160 hp	Beardmore	faired over
		L.P.2400	L.P.920		L.P.2400		
Weights (lb):							
Empty	1793	1400	1759	1792			
Military Load	96		64	96	134		
Pilot	180		180	180	180		
Fuel and oil	389		421	389			
Loaded	2458		2424	2458	2370	2464	2464
Max speed (mph):							
Ground level	103.1	96		108			
2000 ft	104						
3000 ft	103.7						
6500 ft	102		95	102	98.5		
10000 ft	99.5		87	98.5	97		
14000 ft	93.5						
15000 ft				94	92		
Climb to (m. s.) /							
Rate (ft/s):							
1000 ft	1 00						
3000 ft	3 30	4 00				5 30	4 25
6000 ft	8 05						
6500 ft	8 36 / 575		10 00 / 400	9 00	10 00 / 530		
10000 ft	15 55 / 450		19 00 / 250	15 30	17 45 / 380	24 55	18 20
12000 ft	21 10						
14000 ft	29 00						
15000 ft				34 00	36 55 / 170	54 15	34 55
16000 ft	40 45						
17000 ft	49 30						
Service Ceiling (ft)	16000		14000	16000	17500	15000	
Endurance (hrs)	4.5		5.5	4.5	4.5		

Table 110: Martinsyde F.3 and F.4 Buzzard performance figures. The main sources used are JM Bruce [30,41,59] and [1]. Wing span: 32 ft 9.375 in (upper), 31 ft 2.375 in (lower); wing area: 320 ft².

Report	M.158	M.200	M.210A	M210B	M.257
Date	Nov 17	May 18	Jun 18	Aug 18	May 19
Aircraft	F.3	F.3	F.4 Proto	F.4 Proto	F.4 Prod
Engine	Falcon	Falcon III	300 hp	300 hp	300 hp
	Exptl		H-S	H-S	H-S
Airscrew	Lang 3770	Lang 3770	Lang 5270	Lang 5270A	Lang 5270B
Weights (lb):					
Empty	1790	1859	1710	1710	1811
Military load	101	124	101	101	101
Pilot	180	180	180	180	180
Fuel and oil	254	283	298	298	306
Loaded	2325	2446	2289	2289	2398
Max speed (mph):					
6500 ft	142		144	144.5	
10000 ft	138	129.5	142.5	143.5	
11000 ft		129	139.5		
15000 ft	132.5	123.5	136.5	139.5	132.5
16500 ft	130.5	119.5	134		
19500 ft			127.5		
20000 ft			126		
Climb to (m. s.) / Rate (ft./s.):					
5000 ft			3 00		
6000 ft	3 35				
6500 ft	4 00 / 1405	4 40 / 1165	4 00 / 1415	4 00 / 1355	4 40 / 1200
10000 ft	6 50 / 1150	8 05 / 740	6 40 / 1175	6 55 / 1100	7 55 / 985
13000 ft		11 48 / 710	9 30 / 970		
15000 ft	11 55 / 790	15 00 / 570	11 45 / 830	12 20 / 760	14 00 / 670
16500 ft		17 48 / 465	13 40 / 725		
19500 ft		24 00 / 250	18 30 / 515		
20000 ft	24 30		19 20		
Service Ceiling (ft)					
	24000	21600	25000	26000	24000
Endurance (hrs)					
	2.5	2	2.5		

Much of the fighter use was in home defence, though it was tried in France. The other fighter usage mentioned was for ground attack, three being fitted with armoured seats in April 1915. A later attempt had both engine and cockpit protected by armour plate weighing 445 lb. Thirteen such versions were produced between mid-April and the start of October 1916. Although it has a bad reputation for operational use, apparently in mid-1916 official statistics indicate it was the most durable of the eight main types in service [59, p 360]. By the end of 1916 it was obsolescent and it suffered badly in ‘Bloody April’ (April 1917). The main source used in this summary is JM Bruce [21, 42, 56, 59]. The engines known to be used include: 70 hp Renault; 90 hp RAF 1a. Performance figures are given in table 111.

- Willy Coppens [68, pp 62–63] records flying a B.E.2c which the Belgian authorities had improved by use of a 150 hp Hispano-Suiza engine and swapping the observer into the rear cockpit and pilot in the front, this would be early 1917 from context. This aircraft had a ceiling of around 11,000 ft.
- Edward Sims cites Duncan Grinnell-Milne [135, pp 33–34] flying B.E.2c for bombing attacks with 2 × 112 lb bombs. Grinnell-Milne also describes chasing an Albatros two-seater which was faster than the B.E.2c.
- Duncan Grinnell-Milne [86, pp 38–39, 72–73] states that the B.E.2c was ‘a joy to fly, stable, easily manoeuvrable if a bit heavy on the controls and strongly built. He also stated he found the B.E.2c very manoeuvrable, but this may have been in comparison with the Shorthorn he had been flying previously. Duncan Grinnell-Milne [86, pp 77–78] states that the B.E.2c while ‘good in her day for so many purposes, was really rather hopeless when it came to the question of aerial combat’. This was largely due to the observer position having poor visibility and consequently limited ability to fire at an enemy.
- J E Tennant [141, pp 115–116] states the air-cooled engines of the B.E.2 meant that, although they were obsolete, they were less vulnerable to overheating in summer in Mesopotamia than were the rotary engines

in the Bristol Scout or the water-cooled engines of the Martinsyde Elephant.

- For the B.E.2c Oliver Stewart [15, p 20] gives a loaded weight of 2,142 lb and states it could climb to 10,000 ft in ‘rather over three-quarters of an hour’ and gives this as the ceiling. The maximum speed is given as 72 mph. For the B.E.2e Oliver Stewart [15, p 22] gives the weight as 2,100 lb, maximum speed as 82 mph and the ceiling as about 17,000 ft.

Table 111: B.E.2 performance figures. The source is JM Bruce [30, 43, 56, 59]. The second column is for an armoured ground-attack version. When flown as a bomber the B.E. with R.A.F.1a engine could carry 1×230 lb or 2×112 lb or equivalent in smaller bombs. Wing span: 37 ft; wing area: 371 ft².

Report Date	M.30 May 16	M.106 Jun 17	M.20 May 16					
Aircraft	B.E.2	B.E.2a	B.E.2c	Armoured B.E.2c	B.E.2c	B.E.2d	B.E.2d	B.E.2e
Engine	70 hp Renault	70 hp Renault	90 hp RAF 1a	90 hp RAF 1a	90 hp RAF 1a	RAF 1a		
Aircscrew						T.7448		T.7448
Weights (lb):								
Empty	1050	1274	1370		1370	1375		1431
Military load			160		160	80	Nil	70
Crew			360	360	360	320	360	360
Fuel and oil			252	345	252			239
Loaded	1650	1600	2142	2374	2142	2120	1950	2100
Max speed (mph):								
Ground level	73	70	75	85.5	88.5	90		
6500 ft	65	65	72		72	75	89.5	82
8000 ft						73		77.3
10000 ft			69		69	71	83	75
Climb to (m. s.) / Rate (ft/s):								
1000 ft	2 55					3 00		1 36
2000 ft						7 55		
3000 ft		9 00				12 15		
3500 ft				10 00	6 30			
4000 ft						18 00		
5000 ft						24 00		
6000 ft						31 15		20 30
6500 ft			20 00 / 300		20 00 / 300	36 00 / 110	17 35 / 280	23 50 / 182
7000 ft	35 00	35 00				40 15		
8000 ft						52 30		32 40
9000 ft						65 10		
10000 ft			42 15 / 108		45 15 / 108	82 50 / 70	33 40 / 165	53 00 / 55
11000 ft								71 00
12000 ft								80 00
Service Ceiling (ft)								
		10000	10000		10000	7000	12000	9000
Endurance (hrs)								
		3	3.25		3.25	5.5		4

7.21 Royal Aircraft Factory B.E.12 and B.E.12a

The B.E.12 (and B.E.12a) was a not very successful attempt at a fighter version of the B.E.2 in 1916–17. Much of the use was in home defence, Palestine or Macedonia. Operational use in France resulted in it being used as a bomber. The main sources used in this summary is JM Bruce [56, 59]. The main engine used was the 140 hp or 150 hp RAF 4a. Performance figures are given in table 112.

- Haupt Heydemarck cites Rudolf von Eschwege [102, p 45] referring to ‘140 hp B.E.s, sturdy, nimble fellows’. Eschwege flew various Fokkers and Albatros scouts and probably others, the only one shown clearly [102, plate 21 opposite p 112] is a V-strutter Albatros.
- Michael Molkenntin [122, p 98] cites Joe Bull of No. 1 Squadron AFC as considering the B.E.12a as ‘fairly fast and good climbers’.

7.22 Royal Aircraft Factory F.E.2

The F.E.2a, F.E.2b, F.E.2c and F.E.2d were two-seat fighter-reconnaissance aircraft used as such in the period 1915–17. The F.E.2b and, to a much lesser extent, the F.E.2d were later used as night-bombers through to the Armistice. The Rolls-Royce engines of the F.E.2d were of greater value in other aircraft, so it disappeared quickly. The underside of the nacelle of the F.E.2a and F.E.2b was armoured. For the F.E.2c ‘the nacelle

Table 112: B.E.12 and B.E.12a performance figures. The source is JM Bruce [30,56,59]. B.E.12 wing span: 37 ft; wing area: 371 ft². B.E.12a wing span: 40 ft 9 in (upper), 30 ft 6 in; wing area: 360 ft².

Trial	Feb 16	May 16	Nov 16
Date	Feb 16	May 16	Nov 16
Aircraft	BE12	BE12	BE12a
Engine	150 hp	150 hp	150 hp
	RAF 4a	RAF 4a	RAF 4a
Airscrew	T.6296		
Weights (lb):			
Empty	1540	1635	1610
Military load	101	80	80
Pilot	180	180	180
Fuel and oil	283	457	457
Loaded	2104	2352	2327
Max speed (mph):			
Ground level		102	105
3100 ft			99.5
5100 ft			95.5
6500 ft	97	97	91.5
7050 ft			89.5
8000 ft		94	
8500 ft			83.5
10000 ft	91	91	80.5
11000 ft			78.5
12000 ft			72
Climb to (m. s.) / Rate (ft/s):			
1000 ft		1 30	1 35
2000 ft		3 30	3 20
3000 ft		5 50	5 00
4000 ft		8 20	7 05
5000 ft		11 05	9 10
6000 ft		14 00	11 20
6500 ft	9 30 / 490		
7000 ft		17 20	13 45
8000 ft		21 50	16 20
9000 ft		27 00	19 30
10000 ft	18 48 / 260	33 00	24 15
11000 ft		40 00	31 45
12000 ft		47 30	44 00
13000 ft		54 00	59 30
14000 ft		62 00	
Service Ceiling (ft)	12 500	12500	
Endurance (hrs)	3	3	

incorporated areas of armour plate'. The main source used in this summary is JM Bruce [18, 56, 59]. The main engines used were F.E.2a: 100 hp Green and 120 hp Beardmore; F.E.2b: 120 hp or 160 hp Beardmore or 150 hp RAF 5; F.E.2d: 250 hp Rolls-Royce Mk I, Mk III or Mk IV, 275 hp Roll-Royce Mk I, Mk II. Performance figures are given in table 113.

- WJ Harvey [96, pp 62-75] reports on a two-pounder gun installed on a F.E.2b night bomber. WJ Harvey [96, pp 110–111] reports on the issue of electrically heated clothing for night bombing.
- AR Kingsford [111, pp 72–73] states that the 160 hp Beardmore powered F.E.2b when used for Home Defence could not reach an altitude greater than about 12,000 ft. When a 300 hp Rolls-Royce engine was put in it could reach no more than about 16,000 ft. AR Kingsford [111, p 101 & 127] states for one operation they carried 1 × 112 lb and 1 × 230 lb bomb, while for train-busting they carried 8 × 20 lb and 1 × 230 lb bomb. AR Kingsford [111, p 115] states the F.E.2c was faster than the F.E.2b and more sensitive on controls.
- Harold Hartney [95, pp 43–53] describes an action in June 1916 in which his 20 Squadron '275 hp' F.E.2d overtook and outmanoeuvred Fokker monoplanes. Harold Hartney [95, p 67] described the Albatros (DI or later) as very fast with a swifter climb than the F.E.2d. Harold Hartney [95, p 72] says the Albatros was far from equalling the capabilities of the F.E.2d which could climb to 10,000 ft in 11 minutes and had a ceiling of 19,000 ft, the climb and dive being better than anything to that date, note: this is inconsistent with the previous comment and the reported climb and ceiling better than those from tests.
- For the F.E.2d Oliver Stewart [15, p 32–33] gives the maximum speed at 6,500 ft as 93 mph and at 10,000 ft as 88 mph. The climb to 10,000 ft taking 32.5 minutes and the ceiling as 12,000 ft. The empty weight 2,509 lb and the loaded weight 3,469 lb.

7.23 Royal Aircraft Factory F.E.8

The F.E.8 was single-seat fighter aircraft used to a minor extent in the period 1916–17. The nacelle was an all metal structure with a girder structure built of steel tubing, aluminium panels were used for the exterior. Provision was made for armour plate to protect the pilot. The main source used in this summary is JM Bruce [56]. The main engines known to be used were: 100 hp Gnome Monosoupape; 110 hp Le Rhône; 110 hp Clerget. Performance figures are given in table 114.

7.24 Royal Aircraft Factory R.E.8

The R.E.8 was a major RFC/RAF corps reconnaissance aircraft particularly used in artillery-observation and some usage as a bomber in 1917–18. The main source used in this summary is JM Bruce [22, 46, 59]. The engines known to be used include: 140 hp RAF 4a; 200 hp RAF 4d; 150 hp Hispano-Suiza; 180 hp Hispano-Suiza; 200 hp Hispano-Suiza (RE8a). Performance figures are given in table 115.

- Oliver Stewart [15, p 28–29] gives the ceiling as below 14,000 ft, the maximum speed as 98 mph at 6,500 ft and a climb to 5,000 ft in 11 minutes and to 10,000 ft in 39 minutes. The empty weight as 1,803 lb and loaded weight as 2,678 lb. The maximum speed near the ground of slightly over 100 mph. These numbers look to be for trial M.108B.

7.25 Royal Aircraft Factory S.E.5

The S.E.5 was made in limited numbers in 1917. The main source used in this summary is JM Bruce [47, 56]. The engine known to be used include: 150 hp Hispano-Suiza 8Aa; 180 hp Hispano-Suiza 8Ab; 150 hp Wolsley Python I; and 180 hp Wolsley Python II. According to JM Bruce [58, p 360] and PR Hare [94, p 43] the distinguishing point between the S.E.5 and S.E.5a was the latter had the reduced span wings, this is supported by the test report M.164 which lists the aircraft as a S.E.5 despite having the 200 hp Viper. Later aircraft were delivered with the 200 hp Hispano-Suiza, effectively equivalent to the S.E.5a. All are water-cooled V8 engines. At most, 59 S.E.5s were built. It was replaced by the S.E.5a. Performance figures are given in table 116.

- Cecil Lewis [115, p 140] remarks that the German aircraft had a marked superiority at high altitudes, 15000–18000 feet. This presumably refers to the Albatros D.III
- The second prototype A4562 was flown to St Omer for testing by service pilots Lt R M Hill (60 Squadron, Nieuport) and Lt F H B Selous (19 Squadron, converting from Nieuport to Spad VII). JM Bruce [47, p 4] quotes Hill's report as saying: 'The S.E.5 has in my opinion certain advantages over the Nieuport and Spad. Its speed is good, it involves little strain on the pilot; it climbs as slowly as a Nieuport and slower than a Spad; it is stronger than a Spad; its gun mountings are superior. Its disadvantage with respect to the Nieuport is that it cannot be manoeuvred with quite the same rapidity although at high altitudes manoeuvres should be possible with a much smaller loss of height'. PR Hare [94, p 36] gives a slightly different quotation to the same text, the major difference is in the second sentence where, after the second comma it says 'it lands as slowly as the Nieuport and more slowly than the Spad'. On the same page

Table 113: F.E.2a, F.E.2b and F.E.2d performance figures. The source are JM Bruce [30, 56, 59] and [1]. When flown as a bomber the F.E.2a or F.E.2b could carry various combinations of 25 lb, 40 lb, 112 lb and 230 lb bombs to a total of about 350 lb. The F.E.2d could carry 6×20 lb or 25 lb bombs. Wing span: 47 ft 10 in (F.E.2a), 47 ft 9 in (F.E.2b–d); wing area: 494 ft^2 (F.E.2a–d).

Trial	CFS	AID	AID	M.41?	
Date	May 16	Mar 16		May 16	
Aircraft	F.E.2a	F.E.2b	F.E.2b	F.E.2d	
Engine	100 hp	120 hp	160 hp	250 hp	
	Green	Beardmore	Beardmore	R-R Mk I	
Weights (lb):					
Empty		1993	2061	2401	2509
Military load		160	160	160	80
Crew		360	360	360	360
Fuel and oil		454	456	628	520
Loaded	2680	2967	3037	2890	3549
Max speed (mph):					
Ground level	75	80.5	91.5	84	92
2000 ft		77.5			
4000 ft		74.5			
5000 ft					94
6000 ft		72.5			
6500 ft			81		93
8000 ft		72		88	
10000 ft		72	76		88
Climb to (m. s.):					
1000 ft	2 45	3 00	2 10	2 00	
2000 ft			4 47	4 00	
3000 ft	8 10	9 50	7 24	6 00	
3500 ft	9 40				
4000 ft			7 24	8 30	
5000 ft			9 50	11 00	7 10
6000 ft		22 45	16 38	29 00	14 30
6500 ft			18 55		
7000 ft			21 20	18 30	
8000 ft		33 45	27 27	22 00	
9000 ft	34 00	42 15	33 09	27 30	
10000 ft		51 45	39 44	32 30	18 20
11000 ft		68 40		39 00	
11300 ft		80 00			
12000 ft				48 00	
15000 ft					42 40
Service Ceiling (ft)	6000	9000	8000	11000	17500
Endurance (hrs)	3	3		3.5	

Table 114: F.E.8 performance figures. The main source is JM Bruce [30, 56]. Wing span: 31 ft 6 in; wing area: 218 ft².

Date	Nov 16	Apr 16	
Aircraft	FE8	FE8	FE8
Engine	100 hp Gnome Monosoupape	110 hp Le Rhône	110 hp Clerget
Airscrew	T.7928	T.7928	
Weights (lb):			
Empty	895	960	
Military load	39	50	
Pilot	180	180	
Fuel and oil	232	280	
Loaded	1346	1470	1390
Max speed (mph):			
Ground level	94.5	93.6	97
10000 ft		89	
Climb to (m. s.) / Rate (ft/s):			
2000 ft		2 10	
3000 ft		4 15	
5000 ft	7 30		
6000 ft		8 20	
6500 ft	11 00	9 18 / 700	
7000 ft		10 10	
8000 ft		12 10	
9000 ft		14 00	
10000 ft	17 30	17 15 / 580	
Service Ceiling (ft)			
	14500		
Endurance (hrs)			
	2.5		

PR Hare cites Lt Selous as saying ‘Control Elevator: The S.E.5 is slightly lighter in the elevator than the Spad, but the machine is harder to keep in a steep dive. Laterally: There is not any difference between the S.E.5 and the Spad. View: The view in all directions is very good, and much better than the Spad, especially forwards and downwards. Climb and Speed: This cannot be judged accurately without flying the machines together, but the S.E.5 has a much greater range of speed than the Spad and will fly at 45 mph. General Flying: Although the S.E.5 is stable, it can be manoeuvred quite as well as the Spad. The S.E.5 can be landed slower than the Spad and has a much flatter glide’.

7.26 Royal Aircraft Factory S.E.5a

The S.E.5a was a major RFC/RAF fighter (scout) in 1917–18. The main source used in this summary is JM Bruce [56, 57, 59]. The text of the Profile says for the prototype Martlesham reported speed at 14,000 ft of 123 mph, that height being reached in 16 mins 50 sec, the ceiling was about 23,000 ft. Early centre-section weakness, undercarriage weakness, mainplane failures and tendency for the tail fin leading edge to blow out were cured by design changes [58, pp 437–9 and 442]. The performance of various aircraft is given in table 117.

Engines known to have been used are 200 hp Hispano-Suiza 8Ba, 8Bb, 8Bd, 8Cb, 8Cd, 8Db, 8Dd, 8Eb, 8Ed; 220 hp Hispano-Suiza 8Bc, 8Be, 8Cc, 8Ce, 8Dc, 8De, 8Ec, 8Ee; 200 hp Wolsley W.4a Viper; 200 hp Wolsley Adder I, II and III (their licensed built versions of the Hispano-Suiza); 200 hp Sunbeam Arab I or II (not used in service). The Viper was a high-compression derivation of the earlier 150 hp direct-drive Hispano-Suiza. The 200 hp geared Hispano-Suiza engines were often fitted with the high-compression pistons of the 220 hp versions during rebuilds. Some sources refer to a 240 hp Hispano-Suiza. It is possible these refer to an equivalent of the 235 hp Hispano-Suiza 8BEc discussed above for the Spad XIII (Section 3.26). Examples of such references are JM Bruce [20], see for example: <http://www.flightglobal.com/> or [139]. All are water-cooled V8 engines. JM Bruce [59, p 480] that by October 1918 all but two of the RAF squadrons had aircraft powered by the 200 hp Wolsley Viper.

Airscrews: Four-blade airscrews T.28096 were usually used on S.E.5a's with French engines with 24:41 gears. The majority of aircraft had two-blade airscrews A.B.8080 or T.28137M on Wolsley built 200 hp geared

Table 115: R.E.8 performance figures. The main source is JM Bruce [30, 46, 59]. 7996 and 7997 were the prototypes. The R.T.1 and R.E.9 were prototypes for improved versions that did not enter production. Bomb load: up to 224 lb, possibly 2×112 lb, 4×65 lb or a mixture. Wing span: 42 ft 7 in (upper), 32 ft 7.5 in (lower); wing area: 377.5 ft^2 .

Report Date	Jul 16	M.108B	M.108	M.108A				M.162	
Aircraft	7996	Sep 17 A4716		Jun 17	Jun 17	A3561	B6626	B6630	Dec 17
Engine	RAF 4a	RAF 4a		R.E.9 RAF 4a	R.E.9 RAF 4a	R.T.1 RAF 4a	R.T.1 Maori	RAF 4a	H-S 200 hp
Airscrew	150 hp	T.6296		T.6296	T.6296			T.6296	
Bomb load	Nil	Nil	$2 \times$ 112 lb	$2 \times$ 112 lb	Nil	Nil			
<hr/>									
Weights (lb):									
Empty	1622		1803	1803				1773	1803
Military Load	232	185	351	351	185			185	185
Crew	360	360	360	360	360			360	360
Fuel and oil	378		255	355			272	272	
Loaded	2592	2678	2869	2869	2645	2800		2590	2707
<hr/>									
Max speed (mph):									
1600 ft	106.5								
5000 ft		103							
6500 ft	99	102	98	94	97			101	
9910 ft	93								
10000 ft		96.5	92.5	85	93.5			98.5	108
11400 ft	90								
13700 ft	86								
15000 ft								90.5	
<hr/>									
Climb to (m. s.) / Rate (ft./s.):									
1000 ft	1 30								
2000 ft	3 05								
3000 ft	4 40								
4000 ft	6 20								
5000 ft	8 10	11 25					11 20	6 45	7 45
6000 ft	10 25								
6500 ft	11 40	15 50 / 325	21 00 / 230	20 00 / 220	18 12 / 250			10 30	10 35 / 485
7000 ft	13 00							10 15	
8000 ft	15 40								
9000 ft	18 30								
10000 ft	22 00	29 05 / 215	39 50 / 140	44 12 / 85	37 30 / 125	35 40		19 10 / 345	18 30
11000 ft	26 05								
12000 ft	31 10								
13000 ft	38 00								
13200 ft	40 00								
15000 ft								41 30 / 140	
<hr/>									
Service Ceiling (ft)	13200	13500	11000	9500	10500	13000		16000	18000
<hr/>									
Endurance (hrs)		4.5							

Table 116: S.E.5 performance figures. The first and third onwards are taken from JM Bruce [30, 47, 56, 58]. A4561 was the first prototype (not recorded here), A4562 was the second prototype and B4862 was the first experimental installation of a Viper. M.164 is taken from ARC R&M 608 [66] and [1]. Wing span: 27 ft 11 in (originally), 26 ft 7.4 in (later); wing area: 249.8 ft² (originally), 244 ft² (later).

Report Date	Dec 16	M.84 Mar 17	M.113 Jun 17	M.111 Jun 17	M.141B Sep 17	M.141A Sep 17	M.164 Dec 17	M.164A Jan 18	M.164B Feb 18
Aircraft	A4562	A4845	A8911	A8916	B4862				
Engine	150 hp H-S	150 hp H-S	150 hp H-S small w'screen (Python)	150 hp H-S	200 hp H-S	CR 5.6:1	200 hp Viper	200 hp Viper	200 hp Viper
Aircraft	T.28041	T.28051	T.28051	T.28051	A.D.662	A.D.662	A.D.662	A.D.662	A.D.662
Weights (lb):									
Empty	1280	1399		128	1406	1406	1459	1429	
Military Load	140	106			107	107	100	100	
Crew	180	180		120	180	180	180	180	
Fuel and oil	227	245			247	247	237	241	
Loaded	1827	1930	1892	1850	1940	1940	1976	1980	1988
Max speed (mph):									
Ground level	128.5			128			137.8		
3000 ft	126								
5000 ft									
6500 ft	122		120						
9000 ft	116								
10000 ft	113		116		130	132.5	125.5	122	122
11000 ft									
12000 ft							122		
14000 ft							118		
15000 ft	90	98	105		122.5	123.5	116	117.5	120
16000 ft							113		
Climb to (m. s.) /									
Rate (ft/s):									
1000 ft	0 55	1 03			0 50		/ 1020		
2000 ft							/ 907		
4000 ft									
5000 ft	4 55		5 35	5 00			/ 794		
6000 ft									
6500 ft	7 05	8 00 / 650	7 50 / 680	7 00 / 740	6 20 / 870	6 30 / 860	6 55 / 765	6 40 / 810	6 18 870
8000 ft							/ 680		
10000 ft	12 25	14 10 / 480	13 40 / 480	12 36 / 520	10 50 / 695	11 00 / 695	12 20 / 564	11 35 / 810	10 48 / 665
12000 ft							/ 457		
13000 ft									
14000 ft							/ 340		
15000 ft	30 30	29 30 / 210	29 10 / 205	27 06 / 210	19 40 / 440	19 55 / 455	24 30 / 280	22 35 / 330	20 48 / 370
Service Ceiling (ft)		17000	17000	16500	22000	22000	18000	19000	19500
Endurance (hrs)		2.5	2.5		2.33	2.33		3	3

engines or French Hispanos with 21:28 gears. With Viper engines A.B.7673 or A.D.662.

Some useful material from memoirs:

- Cecil Lewis [115, pp 149–150] states around Jun 1917 he was detailed to test the first 200 hp S.E.5a supplied to 56 Squadron and decided to find its ceiling. He reached 22,000 ft (this was A4563 [58, p 439]). Cecil Lewis compares the manoeuvrability of the S.E.5a unfavourably with the Sopwith Dolphin [115, pp 150–151], Spad [115, pp 161–162] and Pfalz [115, p 163] (the latter would be the Pfalz D.III from the date). Oliver Stewart [15, pp 94–95] agrees with respect to the Spad. CF Andrews [3, p 6] suggests the reverse.
- James McCudden [119, p 175] describes the S.E.5a good points as ‘its great strength, its diving and zooming powers, and its splendid view. Apart from this it was a most warm, comfortable and easy machine to fly’. For the 19th of August 1917 he describes meeting a formation of Albatros scouts at about 19,000 ft. For the 28th of September 1917 James McCudden [119, p 198] describing a diving attack states his comrades afterwards said they were recording 180 mph. On 21st October he reports [119, p 215] a dive at 200 mph. He further states [119, p 240] his 200 hp Hispano-Suiza powered S.E.5a could always get to 20,000 ft as he had much work done on his aircraft and took a lot of interest. He further states that the average 200 hp S.E.5a could only get to 17,000 ft with its war-load. Later in January 1918 he [119, p 248] states he fitted a spinner from a LVG to his SE5a which made it three miles per hour faster, now at 10,000 ft his SE5a flew over 120 mph. Then [119, pp 254–6] on 28th January 1918 he states he had an engine fitted with high-compression pistons (presumably 220 hp), with this engine he could climb to 10,000 ft in ‘a little more in minutes than there are days in the week’. He further states [119, p 258] that the machine climbed to around 11,000 ft in about 10 minutes. James McCudden [119, pp 264–5] implicitly states that with the 220 hp engine he was able to climb to 22,000 ft. He directly mentions 21,000 ft. The climb from around 17,500 ft to around 21,000 ft in pursuit of a Rumpler took about 50 minutes. James McCudden [120, p 80] advised dive and zoom tactics in a S.E.5a when fighting enemy scouts.
- Bill Lambert [112, pp 70–3] describes his first real encounter with the Fokker D.VII on the 20th May 1918 and states ‘They were much better than the triplane but we found the SE5 could handle them’. At this date this would be S.E.5a versus Mercedes powered Fokker D.VII. Bill Lambert [112, p 78–9] describing action on 31st May 1918 states the S.E.5a could out-fly and out-manoeuve the Pfalz D.III. Bill Lambert [112, p 135] reports dive speeds of close to 200 mph. Bill Lambert [112, p 138] around 4th July 1918 reports a diving attack with a descent speed of about 180 mph where the formation dropped 3000 ft in a few seconds. This is consistent with the report of Mervyn O’Gorman. [125, 126] in which dive speeds of the order of 200 mph are reported. Bill Lambert [112, p 126] reports he had the dihedral of his S.E.5a reduced from the normal 5° to around 2.5° and found his machine was now faster and climbed faster, though less stable in a steep turn. This is also mentioned in general terms for 24 Squadron by JM Bruce [57]. Bill Lambert [112, p 191] in describing an offensive patrol around 7th August 1918 scheduled for 19000 ft states that after about an hour they were flying at 20000 ft.
- J M Bruce [59, p 478] has a photograph of B4891, stated to have been flown by J T B McCudden with 124 hours of flight by James McCudden. This was the aircraft fitted with a spinner from a LVG CV and, later, the high-compression engine.
- Elliot White Springs [136, pp 131–2] in an entry nominally dated 14th May 1918 states that a new S.E.5a with a ‘180 Viper Hispano’ had a maximum speed of 130 mph just off the ground.
- Keith Isaacs [107, p 88] cites Captain A. King Cowper about the S.E.5a as ‘Fast, very manoeuvrable, and strong, it easily outclassed any German aircraft’. He also cites Lieutenant-Colonel E.A. Ewart in [4, p 82] describing the S.E.5a as ‘one of the finest fighting machines we owned, and I have known the machine to be dived from a height (with the engine going full out) at a speed of 240 miles-per-hour’. The claimed dive speed seems unlikely as it is higher than those recorded elsewhere.
- A modern view of a reproduction aircraft is ‘Compared to other Great War fighters it is rugged, reliable and very stable, and an excellent gun platform allowing an accurate shot from a greater distance. If I were comparing it to a more modern aircraft I would have to relate it to a 1950s era Great Lakes trainer, the SE5a certainly doesn’t feel like a ninety year-old design’.
- William McLanachan [121, p 180–184] states that the S.E.5a was capable of 120 mph on the level and of diving at over 200 mph, but initially had unreliable engines and unreliable synchronisation mechanisms (within a fortnight over forced landings through engine failure). The S.E.5a was also less manoeuvrable than the Nieuport 40 squadron had previously flown. William McLanachan [121, p 187] states he tested an experimental installation of an automatic oxygen apparatus and a bomb carrier for 4 × 20 lb Cooper bombs. William McLanachan [121, p 192] states that around October 1917 the flight’s patrols were mostly at 18–19,000 ft.
- William Bishop [9, p 201] states that the S.E.5a was about 25 mph faster than the Nieuport.

- Edward Sims [135, pp 38] cites Carl von Schoenebeck as considering the S.E.5a as the best British fighter of the war.
- Duncan Grinnell-Milne [86, p 193] states that when he joined 56 Squadron he was told that, with respect to the Fokker D.VII “Dive and zoom,” I was told, “dive and zoom — don’t try a dog-fight with them until you’ve had plenty of experience. They can generally outmanoeuvre you.”. He was further told that the S.E. was faster on the level and in a dive, but that the Fokker could outclimb the S.E.5a. Duncan Grinnell-Milne [86, p 213] states that the commanding officer had been told that 56 Squadron would return to England in the winter of 1918–19 to be equipped with an newer and faster type of aircraft, presumably the Martinsyde F.4 Buzzard. Duncan Grinnell-Milne [86, p 221] states that in a diving attack on a balloon ‘we must each of us have been doing well over two hundred and fifty’ and [86, p 227] that ‘in the S.E.’s superior speed on the dive sometimes lay the only road to salvation’.
- Rudolf Stark [137, p 205] describes the S.E.5’s as ‘beautiful machines’.
- Carl Degelow [110, p 139] describes the S.E.5a as having ‘darned good diving ability and great speed’.
- Morrow and Rogers [124, p 137] cite ‘Bo’ Rogers as describing the first encounter between 32 Squadron’s S.E.5a’s and Fokker D.VII’s as ‘if they were putting up their best performance yesterday we have it over them in speed, climb and manoeuvrability’, this was 29th June 1918 and would be Mercedes powered Fokker D.VII’s. Bo Rogers [124, p 150] describes his ‘old kite’ as having done 120 hours with scarcely any repairs and the average life of an engine as about 50–60 hours. Bo Rogers [124, p 178–179] on 6th September 1918 describes attacking a German two-seater with his S.E.5a flying at 21,000 ft.
- Some quotes from Shuttleworth pilots by piecost from Andy Sephon, Chief Pilot of the Shuttleworth Museum Collection from ‘Flying Scale Models, Nov 2002’: ‘So, we find ourselves in a delightfully powerful, manoeuvrable and easily flown machine. The only vice so far seen is an excess of adverse aileron yaw, but it’s easily controlled with judicious use of rudder. Surely the SE must have some vices . . . Now, after every flight must come a landing’ and ‘It’s so easy to criticise an aircraft of the 1914–18 era when compared to modern specifications written nearly a century later. But in the case of the SE, I believe we have an exceptional aircraft. True, the systems require more than normal monitoring, but they do provide several methods of getting fuel to the engine in the event of failure or battle damage. The coolant system also requires time and effort, but otherwise the operation of the machine is simple. In any event, the systems are easily learned and understood. Any pilot who is competent on the Tiger Moth would have no difficulty converting to the aircraft in very few hours indeed’.
- Gwilym Lewis [116, p 93] on 7th August 1917 initially describes the S.E.5 as ‘too heavy and turns too slowly’ and later on 12th August ‘getting to like the SE very much better myself, though it is rather heavy and slow manoeuvring’. Gwilym Lewis [116, p 99] on 19th December 1917 states that 40 Squadron had changed to the S.E.5s some six weeks prior to his joining and ‘most seem to prefer the Nieuport, with their quick manoeuvre, to the better performing S.E.5’. Gwilym Lewis [116, p 103] on 30th December 1917 states the S.E.5 is ‘easily the fastest thing in the sky now’ and that ‘now I have a 230 mph engine in mine by having several inches of dihedral off some unnecessary stability has been got rid, and better climb and better several other things’. Gwilym Lewis [116, p 128] on 24th April 1918 states that the S.E.5 of his flight ‘never play with Tripes when they are above, and keep from close quarters where possible. They manoeuvre much better than we can, but have not nearly so much speed’.
- Ira Jones [108, p 33] states that Mick Mannock had advised him “don’t ever attempt to ‘dogfight’ a triplane on equal terms of height’. Ira Jones [108, pp 81–3] describes diving away from some Fokker’s at about 180 mph.

7.27 Short 184

The Short 184 was an early torpedo carrying floatplane used by the RNAS. The main source used in this summary is JM Bruce [28, 48]. Engines known to have been used include: 225 hp Sunbeam Mohawk; 240 hp Sunbeam Gurkha; 260 hp Sunbeam Maori I, II or III; 240 hp Renault; 250 hp Rolls-Royce (Eagle); 300 hp Sunbeam Manitou. Performance figures are given in table 118.

- Guy Warner [146, p 94] cites Flight Commander AH Sandwell as saying the Short was ‘the pilot’s dream for putting in hours — docile, stable obedient’. The machine had a reputation for reliable service.

7.28 Short Bomber

The Short Bomber was a stop-gap bomber pending production of the Handley-Page O/100. It was based on the Short 184 and was used operationally by the RNAS. Some were transferred to the RFC but were not used operationally. The main source used in this summary is JM Bruce [59, pp 489-490]. Engines known to have been used include: 225 hp Sunbeam Mohawk; 250 hp Rolls-Royce (Eagle). Performance figures are given in table 119.

Table 117: S.E.5a performance figures. The first six are taken from JM Bruce [30, 56–59]. A4563 is the prototype, B7 is an early production version built by Martinsyde, B501 is a production version built by Vickers Weybridge (if this is the machine in M.121, then JM Bruce has worse climb figures in [58, p 613] than in [30]). JM Bruce [30, p 455] states 135 mph at ground level with 240 hp Hispano-Suiza. For ground attack 4 × 25 lb Cooper bombs could be carried. Wing span: 28 ft 7.4 in; wing area: 245.8 ft².

Report Date	M.105A May 17	M.142 Oct 17	M.121 Jul 17	Production	M.142A Oct 17	M.248 Dec 18	Dec 17
Aircraft	A4563	B7	B501	S.C.43153 American	B501	+ parachute – parachute	B4899 CR 5.3:1
Engine	200 hp H-S	200 hp H-S	200 hp H-S	200 hp Viper Wright-Martin Type E	200 hp H-S	200 hp Viper	200 hp Viper
Aircraft	French T.28096	(Adder) T.28096	(Adder) T28091		(Adder)	A.D.662	A.D.662
Weights (lb):	1400	1531	132	122.3	1531	140	1459
Empty	107	107	128	117	107	180	100
Military Load	180	180	180	180	180	180	180
Crew	266	230	230	230	230	230	237
Fuel and oil	1953	2048	2034	1988	2048	2048	1976
Loaded							
Max speed (mph):							
Ground level	6500 ft	126	132	122.3	137.8	113.5	125.5
	10000 ft	125	128	117	123	115.5	118
	11000 ft	123	128	117	123	115.5	118
	14000 ft	121	116.5	115.5	116.5	102.5	104.5
	15000 ft					113	116
	16000 ft						
	16500 ft						
Climb to (m. s.) / Rate (ft/s)	1000 ft	0.50	1.00				
	5000 ft	6.00 / 915	7.30 / 700	6.00 / 765	6.20	8.00 / 680	7.20 / 730
	6500 ft	10.20 / 725	13.15 / 510	11.20 / 580	10.50	13.42 / 510	12.55 / 530
	10000 ft	15.00 / 570	27.35 / 230	22.55 / 305	20.50	26.42 / 275	26.20 / 255
	13000 ft	18.50 / 465					
	15000 ft	22.30 / 380					
	16500 ft						
Service Ceiling (ft)	22000	17000	19000	19500	18500	18000	18000
Endurance (hrs)	3	2.25	2.25	3	2.75		

Table 118: Short 184 performance figures. The main source used here is JM Bruce [30] [48]. Bomb load: 14 in torpedo or 1 × 52 lb, 1 × 500 lb, 4 × 112 lb, 4 × 100 lb, 3 × 65 lb plus several 16 lb, 1 × 264 lb and 1 × 100 lb, 1 × 100 lb depth charge. Wing span: 63 ft 6.5 in; wing area: ≈ 680 ft².

Date		May 17	Jul 17			
Aircraft		8014	8076	N1090	N1135	Type D
Engine	Mohawk	Gurkha	Maori	Renault	Renault	Gurkha
Load		4 × 64 lb	4 × 100 lb			9 × 65 lb
Weights (lb):						
Empty		3634	3479	3798	3514	3620
Military load		325	512	668	650	671
Crew		360	360	360	360	180
Fuel & oil		690	637	734	666	690
Loaded	5100	5009	4988	5560	5190	5163
Max speed (mph):						
Sea level		74			70	
2000 ft	75		84	80	85	
6500 ft		75	83	70	78	77
10000 ft			80.5			
Climb to (m. s.):						
2000 ft			6 15	8 15	9 20	
6500 ft		39 00	26 15	42 30	51 30	40 30
Service Ceiling (ft)						
			8700	5700	5000	
Endurance (hrs)						
				4.5	5	

Table 119: Short Bomber performance figures. The main source used here is JM Bruce [59, p 490]. Bomb load: 4 × 230 lb or 8 × 112 lb. Wing span: 85 ft (upper); wing area: 870 ft².

Aircraft	
Engine	250 hp
	Rolls-Royce
Weights (lb):	
Empty	
Loaded	6800
Max speed (mph):	
6500 ft	77.5
Climb to (m. s.):	
6500 ft	21 25
10000 ft	45 00
Service Ceiling (ft)	
	9500
Endurance (hrs)	
	6

Table 120: Sopwith Tabloid performance figures. The main source used here is JM Bruce [30, p 522] [59, p 498]. Wing span: 23 ft 6 in; wing area: 241.3 ft².

	Aircraft	Prototype	Production
Weights (lb):			
Empty		670	730
Loaded		1060	1120
Max speed (mph):			92
Climb to (m. s.):			
1200 ft			1 00
Service Ceiling (ft)			
Endurance (hrs)			3.5

Table 121: Sopwith Spinning Jenny performance figures. The main source used here is JM Bruce [30, p 532] [56, p 115]. Wing span: 36 ft.

Aircraft	
Weights (lb):	
Empty	
Loaded	
Max speed (mph):	
Ground level	69
Climb to (m. s.):	
3000 ft	20 00
Service Ceiling (ft)	3000
Endurance (hrs)	2.5

7.29 Sopwith Tabloid

The Sopwith Tabloid was a single-seat scout (fighter) used in small numbers by both the RFC and RNAS. The main source used in this summary is JM Bruce [31] [59, pp 493–498]. Engines known to have been used include: 80 hp Gnome; 100 hp Gnome Monosoupape. Performance figures are given in table 120.

7.30 Sopwith Spinning Jenny

The Sopwith Spinning Jenny was a two-seat Home Defence scout (fighter) used in small numbers by the RNAS. The main source used in this summary is JM Bruce [56, pp 111–115]. Engines known to have been used include: 80 hp Gnome. Performance figures are given in table 121.

7.31 Sopwith Schneider and Baby Seaplanes

The Sopwith Schneider and later Baby seaplanes were single-seat floatplanes versions of the Sopwith Tabloid and were used in considerable numbers by the RNAS. Considerable variation in the design and, in particular, the engine were made over the time it was in production. The main source used in this summary is JM Bruce [30, pp 532–540]. Ian M Burns [63, pp78–80] discusses the problems with the Sopwith Schneider and Baby when operating from seaplane carriers and states they were dropped from the seaplane carriers in favour of single seat fighters operating from aircraft carrier flying off platforms and later from platforms on other ships. The Schneider and Baby were retained to operate from sheltered coastal waters. Engines known to have been used include: 100 hp Gnome Monosoupape; 110 hp Clerget; and 130 hp Clerget. Performance figures are given in table 122.

- Ian M Burns [63, pp 78–79] cites some pilot comments on the Sopwith Schneider/Baby. Gerry Livock: ‘they were considered to be very difficult to handle’ and ‘they were lovely little things to fly and, at 80 knots, were quite fast for those days’. Flight Sub-Lieutenant G F Hyams: ‘they were absolutely perfect! They had Clerget engines [...]. They would all handle most beautifully and were really a delight to fly, you could turn them on a sixpence’.

Table 122: Sopwith Schneider and Baby Seaplane performance figures. The main source used here is JM Bruce [30, pp 539–40]. Wing span: 25 ft 8 in; Wing area (upper) 128 ft², (lower) 112 ft².

Aircraft		
Engine	110 hp Clerget	130 hp Clerget
Weights (lb):		
Empty		1226
Military load		75
Pilot		180
Fuel and Oil		234
Loaded	1580	1715
Max speed (mph):		
Sea level	92	100
Climb to (m. s.):		
10000 ft		35 00
Service Ceiling (ft)		
Endurance (hrs)		2.25

7.32 Sopwith 1½ Strutter

The Sopwith 1½ Strutter was a major RNAS, RFC and Aviation Militaire two-seat fighter-reconnaissance, bomber or single-seat bomber aircraft from April 1916 through to late 1917. There was limited operational use by the USAS. The French two-seat fighter-reconnaissance versions were denoted 1A.2, the two-seat bomber was denoted 1B.2 and the single-seat bomber was denoted 1B.1. The British mostly used the A, C, E and P type cameras in this aircraft; the E and P types at least had plate magazines and semi-automatic plate changers. The French used the 26 cm, 50 cm and 120 cm cameras; these had plate magazines and semi-automatic changers. Finnegan shows a 50 cm camera installed in the fuselage of a 1A.2 [76, p 287] The main source used in this summary is JM Bruce [29, 49, 56, 59]. Engines known to be used include: 110 hp Clerget 9z; 130 hp Clerget 9B; 135 hp Clerget 9Ba; 135 hp Clerget 9Bb; 145 hp Clerget 9Bc; 110 hp Le Rhône 9j; and 135 hp Le Rhône 9Jby. Performance figures are given in table 123. The 1½ Strutter was also produced and used in France, in very large numbers and Russia. Belgium also used the aircraft.

- CPO Bartlett [6, p 36] on 16th March 1917 reports N5093 flying at an indicated air-speed of 100 knots at 20–50 ft. CPO Bartlett [6, p 45] on 7th May 1917 reports N5150 reaching just over 17,000 ft after dropping bombs, these aircraft had bomb cells placed in the rear cockpit for long-distance bombing and so had no gunner.
- Harold Balfour [5, pp 66–67] states the Strutter had ‘an evil reputation for weakness when thrown about in aerial fighting’ in late 1916.
- Willy Coppens [68, p 80] states the Strutter was rather slow in manoeuvring.
- Alan Bott [11, p 61] in August 1916 states that a patrol height was 12,000 ft. Alan Bott [11, pp 215–216] states that a captured German letter stated that the ‘most feared’ of British machines is the Sopwith Strutter. Alan Bott [11, p 219] states a three-hour reconnaissance flight was to be flown at 10,000 ft. Alan Bott [11, pp 269–270] describes a photographic patrol that had to be flown at 7,000 ft.
- Norman Macmillan [117, p 39] around February 1917 states an inquisitive speed test obtained 97 mph on a training school machine. Norman Macmillan [117, p 57] in late February 1917 describes a dive of 120 mph as though this is a fast dive speed. Norman Macmillan [117, p 66] in May 1917 states the service machines in full war trim and 110 hp Clerget had a maximum speed of 95 mph at 1325 rpm at low heights, speed fell off rapidly with height and at 10,000 to 12,000 ft (the usual operating height) it dropped to about 80 mph. Norman Macmillan [117, p 113] states that in June 1917 45 Squadron was re-equipped with Strutters powered by the 130 hp Clerget which did not appreciably increase the maximum speed, but did increase appreciably the service ceiling.

7.33 Sopwith Pup

The Sopwith Pup was a major RNAS/RFC fighter from late 1916 through to late 1917. It was initially ordered by the RNAS and later by the RFC. The main sources used in this summary are JM Bruce [23, 40, 56] and [59, pp 512–519]. Engines known to be used include: 80 hp Le Rhône 9C; the 80 hp Gnome; 80 hp Clerget; and 100 hp Gnome Monosoupape. Performance figures are given in table 124.

- In late July or early August 1916 Sir Gordon Taylor [140, p 130] states his service Sopwith Pup had a maximum speed between 95 and 100 mph, climbed to 10,000 ft in 15.5 min and to 15,000 ft in 29 min, the

Table 123: Sopwith 1½ Strutter performance figures. The main source used here is JM Bruce [30, 49, 56, 59]. Bomb load (British): 4 × 25 lb (two-seater); 12 × 25 lb or 4 × 65 lb bombs (single-seater bomber); anti-submarine patrols carried 2 × 65 lb bombs. Bomb load (French): 4 × 120 mm (two-seater); 18 × 120 mm or 6 × 155 mm or 12 × 120 mm + 2 × 155 mm. Wing span: 33 ft 6 in, wing area: 346 ft².

Report Date	D.21 Dec 16	M.125 Dec 16	M.125 Jul 17	D.23 Nov 16				
Aircraft	RNAS 2-seat fighter	RFC 2-seat fighter	A8194 2-seat fighter	NS112 1-seat bomber	Westland 1-seat bomber	French SOP 1A.2	French SOP 1B.1	
bomb load	fighter racks	fighter	fighter	bomber	4 × 65 lb bomber	bomber		
Engine	130 hp Clerget	130 hp Clerget	110 hp Le Rhône	130 h Clerget	110 hp Clerget	145 hp Clerget	135 hp Le Rhône	135 hp Clerget
Weights (lb):								
Empty	1305	1308	1411	1259	1281	1643	1316	1139
Military load	157			160	160	180	344	265
Crew	360	360	360	360	360	180	180	353
Fuel & oil	328			370	404		502	264
Loaded	2150	2223	2321	2149	2205	2386	2342	2041
Max speed (mph):								
ground level								
4000 ft				106	103			
6000 ft				101	101			
6500 ft	100.5	99.5	100	100		84	102	104
8000 ft				99				99
10000 ft	97.5	87.5	89.5	96.5	101	80	98.5	100
12000 ft				92				93
13000 ft					99			
14000 ft								
15000 ft								
								86
								87
Climb to (m. s.):								
1000 ft				1 20				
2000 ft				2 40				
3000 ft				4 10				
4000 ft				5 45				
5000 ft				7 45				
6000 ft				9 45				
6500 ft	9 10		16 27	10 50	10 30		12 40	12 45
7000 ft				11 50				10 40
8000 ft				14 25				
9000 ft				17 25				
10000 ft	17 50	29 00	35 00	20 25	18 55	36 00	24 25	23 40
11000 ft				23 50				17 40
12000 ft				27 40				
13000 ft				35 00				
15000 ft	41 55				41 30			
Service Ceiling (ft)	15500				16000		13000	
Endurance (hrs)	3.75			4.5		8	2.25	2.25
								4.25

next 2,000 ft took 11 min and 19,000 ft in 55 min. He reached a maximum height of 20,500 ft. Sir Gordon Taylor [140, p 4] in discussing an action on 27th May 1917 states that the Pup was outperformed by the Albatros at any height, but between 15,000 to 20,000 ft the Pup performance was relatively better and they had some chance against the Albatros. Sir Gordon Taylor [140, p 123] states that aircraft which had survived more than a hundred hours flying in France were normally returned to Aircraft Depot to be rebuilt to sent back to England as training machines.

- James McCudden [119, p 166–170] on 26th July 1917 describes using the Pup's superior manoeuvrability and light wing loading at 16,000 to 17,000 ft against the Albatros V-strutter which was greatly superior to the Pup at 10,000 to 12,000 ft. James McCudden [119, p 171] states a Pup he flew at Joyce Green on 4th July 1917 whilst instructing climbed to 10,000 ft in 12 minutes, where the average one in France would take under 14 minutes. James McCudden had been flying Pups in France with 66 Squadron. James McCudden further states, on the same page, that his Pup at 10,000 ft flew at an indicated air-speed of 88 mph, equivalent of a corrected speed of 104 mph.
- Arthur Gould Lee [114, p 21] states his service Sopwith Pup climbed to 10,000 ft in about 15 min and took nearly 30 min to reach 15,000 ft on the 24th May 1917. On the 2nd of June 1917 [114, p 42–45] he describes an combat incident where he dived from close to 12,000 ft to 500 ft in around 45 s in escaping from six or seven Albatros D.III aircraft. Arthur Gould Lee [113, pp 55–63] describes a high patrol in which three Pups climbed to 10,000 ft in around 15 min and took 30 min to reach 15,000 ft. Two of the Pups reached 20,500 ft and the third 21,000 ft. A group of five Albatros D.III tried to intercept, but reached their ceiling at around 19,000 ft. The Pups used dive and zoom tactics to attack the D.IIIs two of which appeared to be hit and left. The others, realising they were at a disadvantage, dived away. The Pups followed, part of the time in an 'almost vertical' dive, they descended about 10,000 ft in 'about a minute'. Arthur Gould Lee states [113, p 77] states that the Albatros D.III is 25 mph faster than the Sopwith Pup.
- Oliver Stewart [15, pp 47–48] gives figures of maximum speed at 6500 ft of 106.5 mph, the climb to 10,000 ft taking just over 15 minutes and 15,000 ft taking 30 minutes. He states that the Pup's ability to hold it's height at 8,000 ft upwards was of enormous value in combat. The Pup's speed was not high enough to be a predominant factor in combat.
- Arch Whitehouse [147, p 280] records flying a Pup in an exhibition against a Sopwith Snipe. He was able to turn inside the Snipe.
- Guy Warner [146, p 169] cites Squadron Commander Rutland as not being keen on the skid undercarriage for Sopwith Pup's on HMS Furious as they were unsprung and prone to breaking due to their rigidity.

7.34 Sopwith Triplane

The Sopwith Triplane was a major RNAS fighter from mid-February 1917 through to early 1918. The main source used in this summary is JM Bruce [32, 50, 56, 59]. Engines known to be used include: 110 hp Clerget 9Z; 130 hp Clerget 9B; and 110 hp Le Rhône 9J. Performance figures are given in table 125.

- Roderic Dallas is cited as testing Triplane N500 (first prototype) and reaching 21000 and 23000 feet in September 1916 [99, pp 73–77]. Roderic Dallas is quoted in his logbook around May 1917 as having flown an Albatros and 'was pleased to see Teddy walk past me on the Triplane' [99, p 110].
- 'Eric' Crundall [70, p 87] on 14th August 1917 refers to flying at 20,000 ft and states with regard to the Albatros 'impossible to follow a Hun in a very steep dive because the Triplane is not strong enough to stand the strain'. 'Eric' Crundall [70, p 90] on 19th August 1917 states 'Aviatiks are faster than Triplanes'.
- Oliver Stewart [15, pp 59–60] states the triplane spun rather slowly and its flick roll was rather slow. With the 130 hp Clerget the triplane did 107 mph at 10,000 ft and the absolute maximum was 114 mph. The ceiling was 20,500 ft and it climbed to 10,000 ft in 11.8 minutes.
- William McLanachan [121, p 61] states the Sopwith Triplane was faster than the Nieuport (presumably Nieuport 17) and more manoeuvrable near the ground.

7.35 Sopwith F.1 Camel

The Sopwith F.1 Camel was a major RNAS/RFC/RAF fighter (scout) in 1917–18. The main sources used in this summary are JM Bruce [25, 39, 56, 59]. Performance figures are given in table 126.

Engines known to have been used are: 110 hp Clerget 9Z; 130 Clerget 9B; 140 hp Clerget 9Bf; 110 hp Le Rhône 9J; 100 hp Gnome Monosoupape; 150 hp Bentley B.R.1; 150 hp Gnome Monosoupape; 170 hp Le Rhône 9R. All are 9 cylinder rotary engines. The Le Rhône, Clerget 9B and 9Bf were the main engines for RFC aircraft. The B.R.1 was mainly used by the RNAS. Other engines were fitted, often only in small numbers.

- JM Bruce [59, p 527] quotes Brook-Popham on the 130 hp Clerget Camels 'We are unable to get machines out here over 18,000 ft'.
- JM Bruce [59, pp 527–531] discusses various citations of the period, in particular 'Confidential Memorandum No 47' (later Air Publication 1011) of November 1917, in which the performance of Clerget Camels

Table 124: Sopwith Pup performance figures. The main source used here are JM Bruce [30, p 561] [40,56], [59, p 518] and [1]. The Profile includes data from trials tests M.31 (21st October 1917), M.95 (April 1917) and M.95A (May 1917). For ground attack 25 lb Cooper bombs could be carried. Wing span: 26 ft 6 in; wing area: 254 ft².

Report	M.31	M.95	M.95A
Date	21 Oct 1916	April 1917	May 1917
Engine	80 hp Le Rhône	100 hp Gnome Monosoupape	
Airscrew	Lang LP.1020	Vickers 57	
<hr/>			
Weights (lb):			
Empty	787	856	
Military Load	80	80	
Pilot	180	180	
Fuel and Oil	178	181	
Loaded	1225	1297	
<hr/>			
Max speed (mph):			
Ground level	111.5		110
5000 ft	105		
6500 ft	106.5	105	107
7000 ft	103		
9000 ft	103		
10000 ft	100	101.5	104
11000 ft	101		102
13000 ft	98		
15000 ft	85	94.5	100
16500 ft			99
<hr/>			
Climb to (m. s.)/ Rate (ft. per s.):			
1000 ft	0 55		
2000 ft	2 00		
3000 ft	3 05		
4000 ft	4 15		
5000 ft	5 20		5 40
6000 ft	6 45		
6500 ft	8 00 / 650	7 10 / 710	7 05 / 760
7000 ft	8 20		
8000 ft	10 15		
9000 ft	12 00		
10000 ft	14 00 / 455	13 00 / 510	12 25 / 590
11000 ft	16 30		
12000 ft	19 20		
13000 ft	22 05 / 310		18.3 / 445
14000 ft	25 30		
15000 ft	29 10 / 213	26 55 / 250	23 25 / 340
16100 ft	35 00		
16500 ft			28 42 / 250
<hr/>			
Service Ceiling (ft)	17500	18000	18500
<hr/>			
Endurance (hrs)	3	1.75	1.75
<hr/>			

Table 125: Sopwith Triplane performance figures. The main source used here is JM Bruce [30, 50, 56]. N504 was the second prototype. The CFS report was on December 1916 on a 130 hp triplane. Wing span: 26 ft 6 in; wing area: 231 ft².

Report Date	Aircraft	CFS Dec 16	D.24 Dec 16	N5423 wings 3 ft 6 in chord	N5440 small tailplane	110 hp Le Rhône	aircrew A.D.555	N5350 Strutter aircrew Lang	aircrew Lang 7922	M.75 Jul 17 130 hp Clerget L.P.2100
Weights (lb):										
Empty	1135	1101	993	1168	1095	1178	1178	1178	1103	
Military load		80	58	58					80	
Pilot		180	180						180	
Fuel and oil		180	184						180	
Loaded	1502	1541	1415	1538	1451	1548	1548	1548	1543	
Max speed (mph):										
Ground level					121					
1000 ft				115						
3000 ft	122			114						
5000 ft		117								
6500 ft	119	113	116	114	111.5				112.5	
7000 ft		112								
9000 ft		109								
10000 ft	119	107.5	114	117	108.5	100.5	99	104.5	106.5	
11000 ft		107								
13000 ft		104								
15000 ft		98	105						95	
Climb to (m. s.) / Rate (ft/s)										
1000 ft		0 50								
2000 ft		1 45								
3000 ft		2 30								
4000 ft		3 25								
5000 ft		4 35								
6000 ft		5 50	5 40	4 54		6 08	5 25	5 58		
6500 ft			6 20 / 870		5 16				6 30 / 750	
7000 ft		7 15								
8000 ft		8 40								
9000 ft		10 15								
10000 ft	9 25	11 50	10 36 / 790	10 12	9 20	12 28	11 00	12 27	11 48 / 580	
11000 ft		13 35								
12000 ft		15 20								
13000 ft	13 00	17 30	15 00	15 42		18 55	17 00	19 22		
14000 ft		19 50								
15000 ft		22 20	19 00 / 460				24 00		22 18 / 380	
16000 ft		25 00								
16400 ft		26 30								
Service Ceiling (ft)		20500	20000						20500	
Endurance (hrs)		2.75	2.75						2.75	

fails to meet those recorded as the official performance. English produced Clergets gave worse performance than French produced engines. The effective power at height of both engines appeared to fall off disproportionately with respect to the power on the ground with time. 'Up to 10,000 or 12,000 feet the performance of the Camel is satisfactory; thence upward the climb falls off rapidly and at 15,000 feet quick manoeuvring becomes impossible'. The result was a shift from the 130 hp Clerget to the 110 hp Le Rhône or 140 hp Clerget, but there still seemed to be complaints about the 140 hp Clerget.

- In a history of 2 Squadron AFC, Charles Schaedel [132, pp 40 and 53] describes the use of 'sweep' formations in which top cover was a S.E.5a Squadron at 16,000 ft and Camel Squadrons at between 12,000 and 14,000 ft. Camels were said to be more evenly matched with the Fokker D.VII at lower altitudes. After 4 Squadron AFC was re-equipped with Snipes this was sometimes reversed with Snipes as top cover.
- 'Harry' Cobby [67, p 76] describes the Camel in July 1918 as 'at their best up to about twelve thousand feet', saying that 'the performance fell off rapidly above this level, and against the new Fokker, would put up an indifferent show', this refers to the Fokker D.VII.
- Guy Knocker [62, pp 237–240] describes the Albatros D.V and Pfalz D.III as being faster than the Camel both at the level and in a dive. However, he says the Camel could out-maneuvre both. He also states the Fokker Triplane had a similar performance to the Camel, but climbed better.
- Victor Yeates has his character Tom Cundall [150, pp 29–31, 44–45, 154–156, 202–203, 406 and 419–420] compare the Le Rhone powered Camel favourably with the German fighters of early 1918 (Albatros DV and Pfalz DIII) in terms of manoeuvrability (more 'splitarse') but slower on the level and in a dive 'could neither catch anything except by surprise, nor hurry away from an awkward situation' and 'it was difficult for Camels to attack with their inferiority of speed and climb'. The later Fokker DVII was described as 'very fast, splitarse and marvellous climbers'.
- Arthur Gould Lee [114, pp 165–166, 210, 214–15] states that after re-equipping with Sopwith Camel's he found that the Camel could not catch an Albatros in a dive and found the DV was faster on the level. On the 19th November 1917 in what is described as a 70° dive after Albatros the Camels reached 140 mph, but could not catch the Albatros although starting with a 2000 ft advantage. On the 30th of December 1917 a 'nearly vertical' dive reached a speed of 130 mph.
- Harold Balfour [5, pp 126–127] states his preference for the Sopwith Camel over the S.E.5a as being due to the ability to 'get away' from an enemy using superior manoeuvrability.
- Leonard Rochford [130, pp 95–96] states, in early July 1917 with respect to the Bentley powered Camel, that he 'never met a German fighter which could outclimb me though some of them were faster on the level and in a dive. None could out-maneuvre the Sopwith Camel'. Rochford states [130, p 101] that on 17th July 1917 he took his Camel B3807 up to 22,000 ft when testing a new oxygen apparatus and that when he turned on the oxygen apparatus 'it was comparable to an overcast sky changing to brilliant sunshine and I felt very much more alert'. On the same page Rochford mentions initial troubles with the Bentley engine which were solved through Bentley modifying material making up coil springs in the oil pump. Rochford describes an unofficial comparison of the Bentley, Le Rhône and Clerget Camels [130, p 162] on 21st May 1918 in which it appears the Bentley and Le Rhône speeds may be similar and the Clerget slower. Rochford also gives climbing times for his Bentley powered Camel: 10,000 ft in 11 min; 15,000 ft in 20 min; 18,000 ft in 30 min; and 20,000 ft in 40 min.
- Edward Sims cites Joseph Jacobs [135, p 55] as considering the Sopwith Camel to be the best English fighter of the war.
- Norman MacMillan [117, pp 117 and 134] states 45 Squadron began to convert to Camels on 24 July 1917; the process was completed by 1 September. Norman MacMillan [117, pp 118 and 144] describes the Clerget powered Sopwith Camel as slower in climb and speed than the Albatros, but able to outmanoeuvre them: they seldom had the initiative in starting a scrap, but very quickly took it over when the scrap began. Norman MacMillan [117, pp 213–4] states that Sir Sydney Camm said he believed that many Camel crashes were due to the struts between the fuselage and the upper centre section not having been pinned, but merely fitted into sockets, which mean that they were held in position only by the bracing wires.
- Gwilym Lewis [116, p 113] states that the Camels of 4 Squadron AFC were 'dreadfully slow' at 15,000 ft.
- 'Eric' Crundall [70, p 97] states on 9th September 1917 that 'the view from the pilot's seat in a Camel is not so good as from a Triplane'. Eric Crundall [70, p 116] states on 27th June 1918 that 'with four 20lb bombs onboard the ceiling of a Camel is about 3,000 ft'. 'Eric' Crundall [70, p 120–1] when flying a Bentley powered Camel on 4th July 1918 refers to climbing to 19,000 ft. 'Eric' Crundall [70, p 130–2] describes offensive patrols on 30th and 31st July 1918 at 19,000 ft, on 1st August 1918 when attacked by a Fokker D.VII at 18,000 ft he describes an upward spiral turn to the right where he was able to return the attack when the Fokker's nose dropped as it was unable to maintain the climb. 'Eric' Crundall [70, p 134] describes an offensive patrol on 9th August 1918 at 20,000 ft. 'Eric' Crundall [70, p 139] on 12th August

1918 reports another Camel pilot describing being attacked by monoplanes which outmanoeuvred him in every way, these are likely the Fokker E.V.

- Oliver Stewart [15, pp 53–57] describes how the super-sensitive nature of the Camel allowed those who knew the machine to exploit its powers of manoeuvre. The maximum speed with 110 hp Le Rhône was 120 mph and with the 130 hp Clerget it was a fraction faster.

7.36 Sopwith 2F.1 Camel

The Sopwith 2F.1 was a version of the F.1 Camel that was modified for shipboard use. The fuselage was made in two parts that were butt jointed behind the wind trailing edge, the wing span was reduced. The armament was one Vickers and one Lewis. The main source used in this summary is JM Bruce [56]. Engines known to have been used are: 150 hp Bentley B.R.1; 130 hp Clerget 9B. Performance figures are given in table 127.

7.37 Sopwith 5F.1 Dolphin

The Sopwith 5F.1 Dolphin was a RFC/RAF fighter (scout) in 1917–18. It was used by only four RFC/RAF squadrons on the Western Front. The Mark II version was also intended to be used by the Aviation Militaire. No Mark II versions had reached the front at the Armistice. At least one Mark II was produced in France, orders were cancelled at the Armistice. The main sources used in this summary are JM Bruce [55] and Davilla and Soltan [71, p 473]. Performance figures are given in table 128.

Known engines are Dolphin Mk. I: 200 hp Hispano-Suiza 8E and 220 hp version of this with increased compression ratio; Dolphin Mk. II: 300 hp Hispano-Suiza, 320 hp Hispano-Suiza 8Fb; Dolphin Mk. III: 200 hp Hispano-Suiza with direct-drive. The 200 hp Hispano-Suiza engines were upgraded with increased compression ratio pistons during overhaul. One 220 hp powered Dolphin was possibly the first aircraft fitted with a Rateau supercharger with which it achieved 210 kph. All are water-cooled V8 engines.

- Charles Schaedel [133, p 51] says that ‘Jerry’ Pentland in April 1918 found the Dolphin ‘stable and easy to fly, and the only aircraft in his experience that could be turned at 20,000 feet without the risk of slipping down through several hundred feet of hard-won sky’. ‘Jerry’ Pentland [133, p 54] had his Dolphin armed with two Vickers guns and two Lewis guns, aligned to converge at a point 180 m in front. Charles Schaedel [133, pp 56–58] describes ‘Jerry’ Pentland’s participation in trials of bottled oxygen and electrically heated suits while serving with 87 Squadron in June 1918. Charles Schaedel [133, pp 59–60] says that ‘Jerry’ Pentland engaged a two-seater a 22,000 ft.
- Elliot White Springs [136, p 98] in an entry nominally of 12th April 1918 states that ‘Dolphin does not turn as well as a S.E.5, but better than a Spad’, this is contrary to other accounts given under the S.E.5 entry.
- Rudolf Stark [137, p 127] on 21st August 1918 describes meeting Sopwith Dolphins and says ‘about whose speed and climbing capacities we have heard such wonderful tales’.
- Joseph Doerflinger [72, p 28–29] on 5th September 1918 describes a formation of Fokker D.VII’s being attacked at 20,000 ft by Sopwith Dolphin’s diving from above.

7.38 Sopwith 7F.1 Snipe

The Sopwith 7F.1 Snipe was a fighter that entered service with the RAF in a small scale late in 1918. It was in the process of replacing the Camels, four squadrons used the Snipe on the Western Front by the Armistice. A long-range version, Snipe 1a, was being produced as a stop-gap prior to the availability of the long-range Martinsyde Buzzard: intended as escorts for long-range bombing. Early production Snipes had plain ailerons, later balanced ailerons were introduced to improve manoeuvrability. The main source used is JM Bruce [30, 38, 59]. JM Bruce considers the Snipe ‘not much of an improvement over the Camel’ [59, p 549]. The main engine was the 230 hp B.R.2. The performance data is shown in table 129.

- ‘Harry’ Cobby [67, pp 91] describes the Snipe, which he did not fly in combat, as ‘much faster than the Camel, had a far higher ceiling, and did not possess any of its vices’. He further said that 4 Squadron AFC when the Snipe was introduced ‘gave the enemy some nasty shocks’ as they had ‘been used to have his own way higher up’.
- Guy Knocker [62, pp 171–172] flew a prototype Snipe around 18th March 1918 and records 10,000 ft in 7 minutes, 15,000 ft in 13 minutes and 20,000 ft in 20.5 minutes. He recorded it as too stable and with too small a rudder.
- Leonard Rochford [130, p 200] states that in a single flight in a Snipe he found it ‘quite a nice aeroplane to handle. With its 220 hp BR2 rotary-engine it was slightly speedier and better in climbs than the Camel but it had not the wonderful manoeuvrability of the latter’.
- Michael Molquentin [122, p 323] cites Karl Bolle of JG III describing the Snipe as ‘a new English fighter aeroplane much better in climb and manoeuvrability than the Fokker DVII’.

Table 126: Sopwith F.1 Canmel performance figures. The first is taken from JM Bruce [30, 39, 56] and [1]. F.1/1 and F.1/3 are prototypes, F.1/1 having tapered wings with single broad-chord interplane struts. F.1/3 was regarded as the production-type prototype. B3835 was being used on experiments on the induction pipe size and holes plus compression ratio. For ground attack 4 × 25 lb Cooper bombs could be carried. Wing span: 28 ft; wing area: 231 ft².

Report Date	M.101 May 17	M.86 Mar 17	M.135 Aug 17	M.86B Jul 17	M.86A May 17	M.123 Jul 17	M.91 May 17	M.118A Jul 17	M.118A Jul 17	M.134 Aug 17	M.131 Aug 17	M.236 Oct 18	F6394 170 hp	2-seater 110 hp
Aircraft	F.1/1	F.1/3	B2312	F.1/3	F.1/3	B3829	N518	B3835	B3835	B3835	B3811	USAS	170 hp	110 hp
Engine	130 hp	130 hp	130 hp	140 hp	110 hp	110 hp	150 hp	150 hp	150 hp	150 hp	100 hp	150 hp	Le Rhône	Le Rhône
Clargeret	Clargeret	Clargeret	Clargeret	Clargeret	Le Rhône	Le Rhône	B.R.1	B.R.1	B.R.1	B.R.1	Monosoupape	Monosoupape	Le Rhône	Le Rhône
Weights (lb):	950	929	962	101	889	889	977	101	101	101	882	993	1048	889
Empty	100	101	101	101	101	101	101	101	101	101	101	101	101	101
Military Load	180	180	180	180	180	180	180	180	180	180	180	180	180	180
Crew	252	243	239	252	238	252	250	250	250	250	224	249	238	360
Fuel and oil	1482	1453	1482	1452	1408	1422	1508	1471	1471	1470	1387	1523	1567	1408
Loaded														
Max speed (mph):	6500 ft 10300 ft 11000 ft 13000 ft 16500 ft	112.5 113 109 106	108 104.5 97.5	113.5	108.5 103	122 118.3 114 111.5	116.5 111 103	112.5 110	117.5 111.5	121 114.5	110.5 102.5	117.5 111 107 104.5	113 108.5	103
Climb to (m, s) / Rate (ft/s):	6 00 / 870 10 35 / 650 13 000 ft 15 000 ft 16 500 ft	6 00 / 880 10 35 / 665 15 45 / 480 20 40 / 355	6 40 / 800 11 45 / 600 23 15 / 305	5 00 / 1100 8 30 / 870 15 45 / 550	5 15 / 1035 9 00 / 790 17 20 / 455	5 10 / 1200 9 10 / 638 13 4 / 638 16 50 / 540	5 30 / 945 9 25 / 690 14 00 / 440 18 00 / 440	5 05 8 50 15 55	4 35 8 10	6 50 11 50 15 18 / 510 19 40 / 410 23 42 / 335	5 50 10 20 17 30	5 30 9 35 41 30		
Service Ceiling (ft)	19000	19000	18500	24000	21000	24000	18000	20000	19500	22000	18500	21500	21500	
Endurance (hrs)	2.75	2.5			2.75		2.5			2.5	2.75	2.25		

Table 127: Sopwith 2F.1 Camel performance figures. The main source is JM Bruce [30, 56]. Wing span: 26 ft 11 in; wing area: 221 ft².

Report	M.85	
Date	Nov 17	Mar 17
Engine	150 hp B.R.1	130 hp Clerget
Weights (lb):		
Empty	1036	956
Military load	91	101
Pilot	180	180
Fuel and oil loaded	223 1530	286 1523
Max speed (mph):		
6500 ft	124	
10000 ft	122	114
15000 ft	117	104
Climb to (m. s.):		
6500 ft	6 00	6 25
10000 ft	11 30	11 40
15000 ft	25 00	23 40
Service Ceiling (ft)	17300	19000
Endurance (hrs)		3

7.39 Vickers F.B.5

The Vickers F.B.5 was a significant RNAS/RFC two-seat fighter-reconnaissance aircraft from late 1914 through to early 1916. The main source used in this summary is JM Bruce [59, pp 569–73]. JM Bruce states that the name ‘Gun Bus’ often associated with the type was apparently not used at the time. Engines known to be used include: 100 hp Gnome Monosoupape; 110 hp Le Rhône 9J; 110 hp Clerget 9Z. Performance figures are given in table 130.

- Harold Rosher [131, p 44] refers to flying a ‘Vickers gun bus’, contrary to JM Bruce’s comments above but may have been a RNAS term, and describes it as ‘very badly balanced’ and did not like the Gnome Monosoupape engine.
- A J Insall [106, pp 55–56] states the F.B.5 was slow, rarely exceeding 68 mph, its engine was prone to discard parts in mid-air, but was an effective aircraft when 11 Squadron first arrived in France in July 1915. A J Insall [106, pp 60–51] describes a combat in which a F.B.5 at 9,000 ft dived on a LVG at around 7,500 ft which was able to pull away from the F.B.5 once the LVG started diving.

7.40 Vickers F.B.19

The Vickers F.B.19 was a minor RFC single-seat fighter in 1917. It was mainly used in the Middle East. The main source used in this summary is JM Bruce [59, pp 597–601]. Engines known to be used include: 110 hp Le Rhône 9J; 110 hp Le Rhône 9J Mk II; 110 hp Clerget 9Z; and 100 hp Gnome Monosoupape. Performance figures are given in table 131.

8 United States of America

8.1 Curtiss H-type

The Curtiss H-4 ‘Small America’ was a two-seat flying boat used in 1914–16 by the RNAS. The Curtiss H-12 ‘Large America’ was a four-man flying boat used by the RNAS and US Navy. The HS was a single engined flying boat used by the US Navy. The H-16 was a development of the H4/H-8/H-12 series and was used by the RNAS and US Navy. The main source used is JWR Taylor [139, pp 467–9]. Engines known to have been used include: two 90 hp Curtiss OX-5 (H-4); two 100 hp Anzani (H-4); two 160 hp Curtiss (H-12); two 275 hp Rolls-Royce Eagle (H-12); two Liberty (H-12); 360 hp Liberty (HS-1); two 345 hp Rolls-Royce Eagle (H-16). Performance figures are given in table 132.

Table 128: Sopwith 5F.1 Dolphin performance figures. The first six are taken from JM Bruce [30, p 606], [51]. The first prototype had a frontal radiator. The second prototype had various side radiators. For the Mark II the first set of figures are British, the second set are French official figures. The Mark III had a 200 hp Hispano-Suiza direct-drive engine. The British figures for Dolphin II climb to 16500 ft appears to be incorrect: it would imply less than four minutes to climb the 6500 ft from 10000 ft, this is less than from ground to 6500 ft! I would suspect a correct value would be closer to the French figure. For ground attack 4 × 25 lb Cooper bombs could be carried. Wing span: 32 ft 6 in; wing area: 263.25 ft².

Report Date	M.104A Jun 17	M.137 Aug 17	M.137A Sep 17	M.172 Jan 18	M.172 Jan 18	M.172A Feb 18	M.174 Feb 18	M.235 Oct 18	
Aircraft	1st Proto	2nd Proto			crash pylons 1 Lewis		Dolphin Mk. 1	Dolphin MkII Mk III	
Engine	200 hp H-S	200 hp H-S		2 Vickers only	2 Vickers only	2 Vickers 1 Lewis	2 cabane 2 Vickers 1 Lewis	British figures 300 hp 8Fb	French official figures 320 hp
Aircrew	Lang L.P.3500	Lang L.P.3500	T.28097	Lang 3800		Lang 3610	Lang 3610	200 hp H-S ungearled A.B. 7673	
Weights (lb):									
Empty	1350	1406	1406	101	136	101	149	1466	
Military Load	101	101	101	180	180	180	180	101	
Pilot	180	180	180	180	180	180	180	101	
Fuel and oil	249	194	194	1911	1959	1970	2018	180	
Loaded	1880	1881	1881	1911	1959	1970	2003	176	
								504	
								373	
								2538	
								2287	
								2000	
Max speed (mph):									
Ground level									
6500 ft	123.5	131.5	121	127.5	121.5	119.5	111.5	117	
10000 ft	116	124	112	119	114			123	
11000 ft								140	
15000 ft	113.5							139	
16500 ft								117	
Climb to (m. s.) /									
Rate (ft./s) 6500 ft	5 30 / 1005	4 55 / 1150	6 25 / 875	6 05 / 900	7 05 / 775	5 30 / 910	6 30 / 800	6 24 / 855	
10000 ft	9 25 / 79	8 15 / 935	10 50 / 690	10 30 / 705	12 05 / 590	10 20 / 685	11 40 / 600	11 00 / 675	
13000 ft								16 00 / 525	
15000 ft	17 20 / 495	14 40 / 625	19 55 / 425	19 30 / 425	23 00 / 335			20 12 / 420	
16500 ft								23 54 / 345	
Service Ceiling (ft)	21500	23000	21500	21000	20000	19000	18500	21000	
Endurance (hrs)	2.25	1.75						24600	
								26000	
								19000	
								2	

Table 129: Sopwith 7F.1 Snipe performance figures. The main source is JM Bruce [30, p 613] [38]. B9964, B9965, B9966 and B9967 are prototypes. The Dragonfly powered unit led to the Sopwith Dragon. For ground attack 4 × 25 lb Cooper bombs could be carried. Wing span: 30 ft (original plain ailerons) 31 ft 1 in (later balanced ailerons); wing area: 256 ft² (early), 271 ft² (later balanced ailerons).

Report Date	M.165 Dec 17 B9964	M.176A Feb 18 B9965	M.176B Apr 18 B9965	M.204 May 18 B9966	M.223 Aug 18 E7987	M.226 Sep 18 E8004 new	M.226B Oct 18	M.226A Sep 18	M.244 Nov 18 Mk 1a	M.254 May 19	
Aircraft							24 hrs	Camel load		hydrovane	Dragonfly
Engine											
Airscrew	L.P.4000	Lang 4040	Lang 4040	Lang 4040	Lang 4040			Lang 4040		Lang 4040	
Weights (lb):											
Empty	1153	1212	1212	1240	1305	1312	1312	1312	1329	1349	1405
Military Load	86	321	349	150	185	185	185	105	231	246	203
Pilot	180	180	180	180	180	180	180	180	180	180	180
Fuel and oil	255	251	251	380	345	343	343	178	531	346	344
Loaded	1674	1964	1992	1950	2015	2020	2020	1775	2271	2121	2132
Max speed (mph):											
10000 ft			124.5	118	119	121	115	117.5	114	111	
11000 ft						117.5			108.5		
15000 ft	119	110	113.5	112.5	109.5	113	107.5	113	103		141
16500 ft						100.5					
Climb to (m. s.) /											
Rate (ft./s.):											
6500 ft	4 10 / 1235	4 55 / 1040	5 00 / 1035	4 55 / 1045	5 00 / 1025	5 10 / 970	5 40 / 900	4 18 / 1220	6 42 / 740	6 30 / 785	
10000 ft	7 30 / 900	8 50 / 760	8 45 / 760	8 50 / 765	8 55 / 760	9 25 / 710	10 20 / 650	7 36 / 930	12 25 / 425	11 55 / 555	7 30
13000 ft						14 24 / 515		11 30 / 690	21 00 / 265		
15000 ft	14 50 / 520	17 40 / 400	17 35 / 400	17 45 / 400	17 35 / 430	18 50 / 390	20 40 / 360	14 36 / 550	32 05 / 120		
16500 ft						23 12 / 290					
Service Ceiling (ft)											
	21500	19500	19500	19500	20500	19500	20000	21000	15000	17300	25000
Endurance (hrs)											
		2.25		3.25	3	3	3		4.5		

Table 130: Vickers F.B.5 performance figures. The main source used here is JM Bruce [30, p 664], [59, pp 569–73]. Wing span: 36 ft 6 in; wing area: 382 ft².

Engine	100 hp Gnome Monosoupape
Weights (lb):	
Empty	1220
Loaded	2050
Max speed (mph):	
5000 ft	70
Climb to (m. s.):	
1500 ft	5 00
5000 ft	16 00
Service Ceiling (ft)	
	9000
Endurance (hrs)	
	4.5

Table 131: Vickers F.B.19 performance figures. The main source used here is JM Bruce [30, p 688], [59, pp 597–601]. Wing span: 24 ft; wing area: 215 ft².

Report	M.97		
Date	May 17		
Aircraft	Mk I	Mk II	
Engine	Monosoupape	Clerget	Le Rhône
Weights (lb):			
Empty	900	890	892
Military load	80	80	80
Pilot	180	180	180
Fuel and oil	325	325	326
Loaded	1485	1475	1478
Max speed (mph):			
10000 ft	102	98	98
15000 ft			90
Climb to (m. s.):			
5000 ft	5 20	5 30	
6500 ft			7 50
10000 ft	14 00	14 30	14 50
15000 ft			37 10
Service Ceiling (ft)			
	17500	16500	17000
Endurance (hrs)			
	2.75	3	3.25

Table 132: Curtiss H-4, H-12, HS and H-16 performance figures. The main source is JWR Taylor [139, p 469]. Bomb load: 2×236 lb bomb (H-12); 2×230 lb bomb or 500 lb torpedo(HS-1); 4×230 lb bombs or a 600 lb torpedo (H-16).

Test	N.M.126			N.M.200		
Date	Feb 18			May 18		
Aircraft	H-4	H-12	H-12	HS-2	H-16	H-16
Engines	2× Eagle VIII			2× Eagle VIII		
Airscrew	A.B.665			A.B.665		
Weights (lb):						
Empty	7293			7363		
Military load	580			472		
Crew	720			720		
Fuel and oil	2057			2115		
Loaded	4983	7989	10650	6432	10900	10670
Max speed (mph):						
2000 ft	85		100	82.5		95
6500 ft	97			96		
10000 ft	93			92		
Climb to (m. s.) /						
Rate (ft/s):						
2000 ft	3 18 / 564			3 42 / 512		
6500 ft	13 42 / 326			14 36 / 330		
10000 ft	29 48 / 140			28 00 / 198		
Service Ceiling (ft)						
			10800	5200	9950	12500
Endurance (hrs)						
			6	6		

8.2 Curtiss JN-3, JN-4 and JN-4A

The Curtiss JN-3, JN-4, JN-4A and JN-4 (Can) were two-seat trainers used in 1915–18 by the RNAS, RFC and USAS. The main source used is JM Bruce [59, pp 201–204, 209–215]. Engines known to have been used include: 90 hp Curtiss OX (JN-3); 90 hp Curtiss OX-5 (JN-4A and JN-4(Can)). Performance figures are given in table 133.

Table 133: Curtiss JN-3, JN-4A and JN-4 (Can) performance figures. The main source is JM Bruce [59, pp 203–4, 211 and 215].

Aircraft	JN-3	JN-4A	JN-4 (Can)
Engine	90 hp OX	90 hp OX-5	90 hp OX-5
Weights (lb):			
Empty	1300		1392
Loaded	1918	1870	1920
Max speed (mph):			
	72.89	75	80
Climb to (m. s.):			
1000 ft	2 25		
2000 ft	5 50		
3000 ft	9 10		
Service Ceiling (ft)			
Endurance (hrs)			

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A Imperial to metric unit conversion

Table 134: Metric to Imperial and Imperial to Metric unit conversion of relevance to WWI aircraft. Please note that these conversions use modern definitions.

Metric	Imperial	Imperial	Metric
1 cm	0.3937 in	1 in	2.54 cm
1 m	3.2808 ft	1 ft	0.3048 m
1 m	1.0936 yd	1 yd	0.9144 m
1 km	0.6214 mile	1 mile	1.6093 km
1 km	0.5400 nautical mile	1 nautical mile	1.852 km
1 m ²	10.763 ft ²	1 ft ²	0.0929 m ²
1 g	0.0353 oz	1 oz	28.35 g
1 kg	2.2046 lb	1 lb	0.4536 kg
1 kW	1.341 hp	1 hp	0.7457 kW