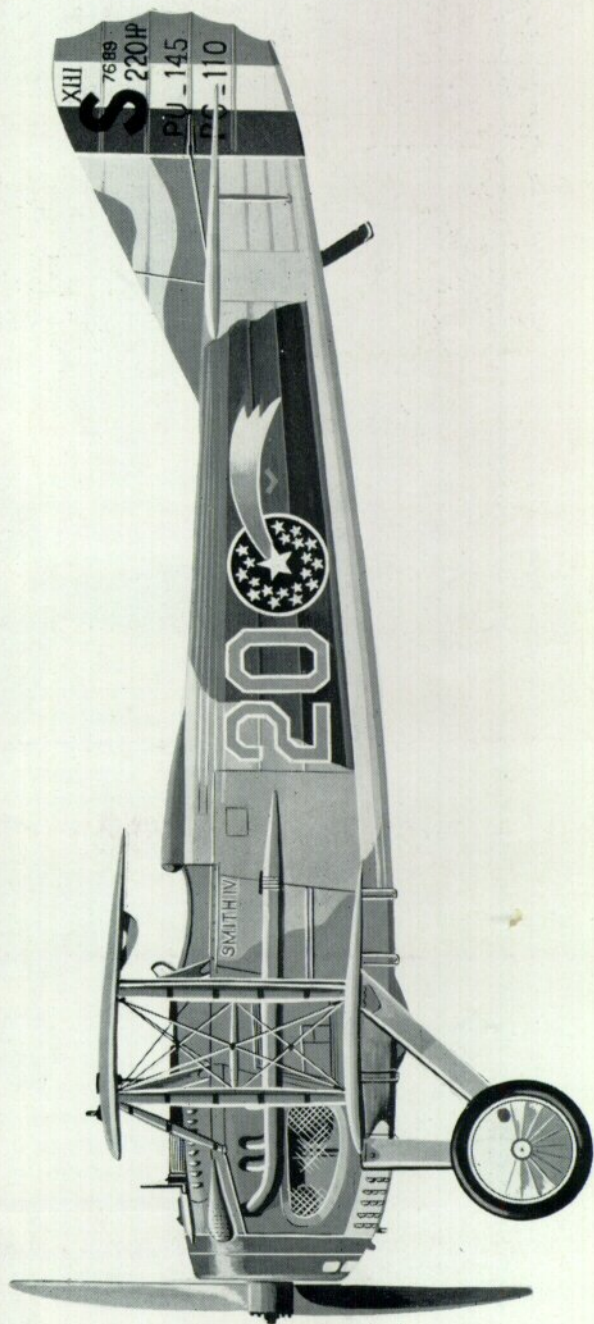


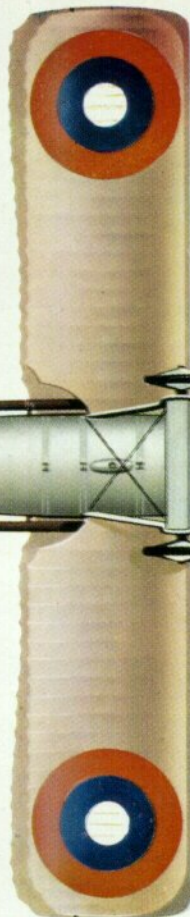
PROFILE PUBLICATIONS

The SPAD XIII C.1

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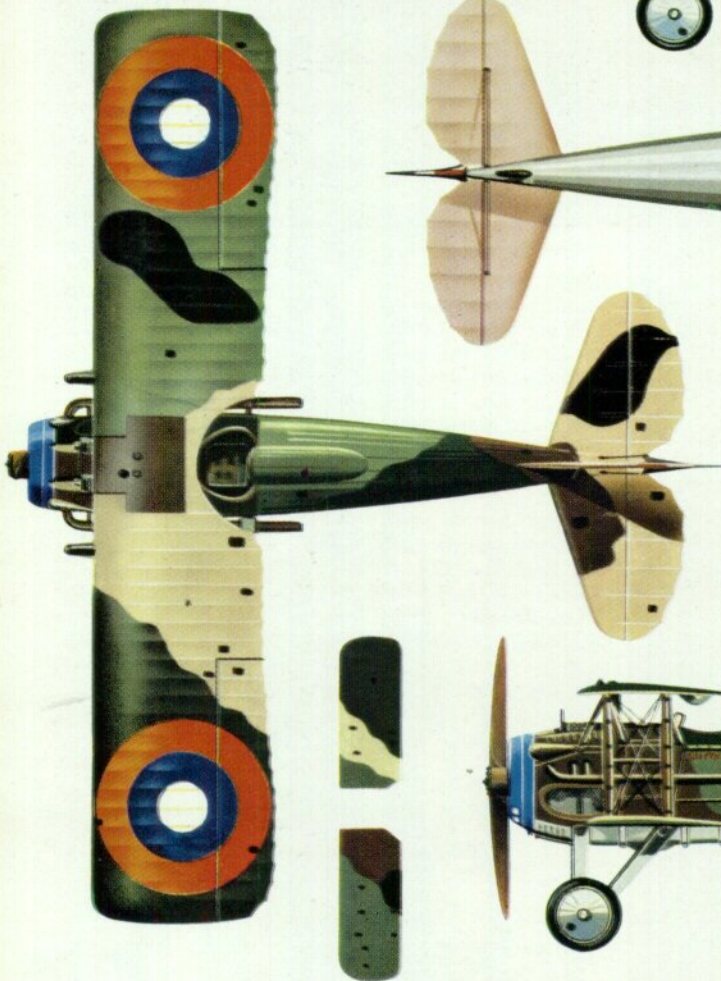
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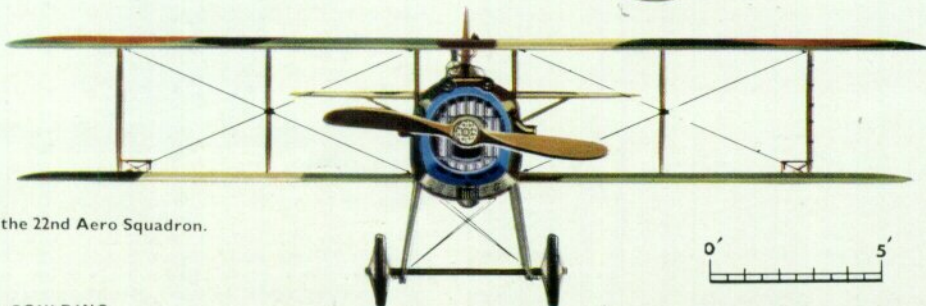
The aeroplane illustrated was flown by two different pilots and shot down six enemy aircraft.



Where enemy bullets struck the aeroplane the repair patches were painted black as an indication. These are shown in their correct position on the illustration.



Camouflage pattern of lower planes.



Spad XIII CI of the 22nd Aero Squadron.

The SPAD XIII C.1



by C. F. Andrews

SPAD XIII of the 22nd Aero Squadron, American Army, 1918.

(Photo: P. R. Molt)

One of the most illustrious families of single-seat fighters of the Great War of 1914–1918 and one that has never received the acclaim accorded to others in the same class, is that represented by the initials SPAD. Much has been written about the S.E.5s, the Fokkers, the Sopwiths and the Nieuports, but no really comprehensive account of the technical merits of the SPAD, or of its service, has yet appeared in a single publication together with an appreciation of its remarkable engine—the Hispano-Suiza. This *Profile*, therefore, sets out to remedy the deficiency and deals with the final development in which the aeroplane went into service in World War I—the SPAD XIII C.1. The designation S.XIII has not been used in this narrative as ‘S’ was merely an abbreviation of SPAD, convenient for use on drawings, documents and on aircraft rudders. Similarly SPAD identified a SPAD fighter *Escadrille*.

Considerable research has unearthed the probable reasons why the SPAD fighter has tended to be largely ignored by writers. The French method of recording aviation history, by glorifying their leading airmen has been, so it seems, at the expense of the aircraft they flew. The “Ace” system was introduced in the First World War with typical Gallic flair in recognising the great value, to combatant and national morale, of publicising the numbers of victories scored by the leading French fighter pilots. The Germans followed suit and only official British policy was against this practice.

Similarly the crack fighter squadrons of the air arm of the French Army (*L’Armée de l’Air*—the French Air Force—came later) were also lionised at the expense of the rest of their flying comrades in arms. Hence the famous *Cigognes* Group consisted of five *Escadrilles* (squadrons) all wearing the *Cigogne* (stork) insignia on their aircraft in varying forms. They were indeed in French eyes

the veritable aristocrats of the air war. All this hero worship had the effect of obscuring the merits of their mounts, the Moranes, Nieuports and SPADs, which served them so well.

A third reason is revealed by examination of French technical and aeronautical publications of the period, and also of published German technical reports on captured Allied aircraft. Security measures were much tighter in France than in Britain because the enemy was sitting on the doorstep, indeed, was in the house for most of the war. Consequently informed French journals such as *Aerophile* rarely published any tangible information on French military aircraft. For some unaccountable reason, there appears to have been no comparative analysis and dissection of the SPAD in German reports such as that presented and published on the S.E.5 reports that were subsequently republished in Allied journals.

True, in the middle months of 1916, a photograph arrived in England on an open postcard which disclosed the existence of a new French tractor biplane with racy lines and a fixed, water-cooled engine, as opposed to the rotary-engined types then much in vogue. Later it became public knowledge that this new fighter was the product of the successors to the former Deperdussin aviation enterprise of pre-war racing and high speed fame.

Founded in 1910, the *Société pour les Appareils Deperdussin* had been taken over in 1914 by the famous pioneer and aircraft constructor Louis Blériot, for Armand Deperdussin, founder of the company bearing his name, had run into serious financial difficulties. Blériot renamed the company the *Société pour Aviation et ses Dérivés*, so retaining the initials SPAD.

The Deperdussin designer, Louis Bechereau, was retained, for he had been responsible for the Deperdussin monoplanes which won the Gordon



Head-on view showing the narrow-chord propeller. Below: Three-quarter rear view shows the aileron bell crank on the bottom of the outer rear strut. (Photos: Musée de L'Air)

Bennett and Schneider Trophy contests of 1913.

THE SPADS ARE BORN

With this background of achievement, Bechereau turned his attention in 1915 to an evaluation of the new Hispano-Suiza engine, then undergoing initial trials at Bois-Colombes, the French works of a Spanish company formed in 1904 to produce high-grade motor cars.

The name Hispano-Suiza had already acquired the magic ring analogous to Rolls-Royce and Napier in the motor car world at that time. The early success of the enterprise has been achieved entirely through the genius of its founder and chief designer, Marc Birkigt, a Swiss engineer, born in 1878. He was a Senior Fellow of the College of Arts and Sciences of Geneva.

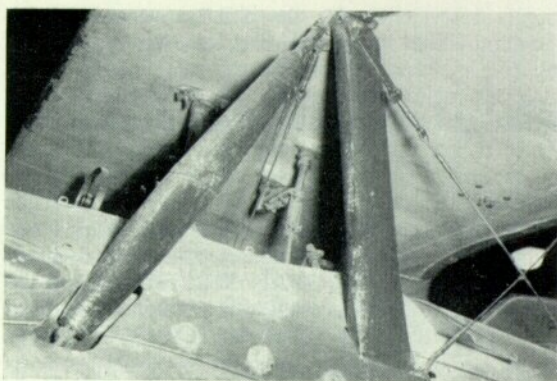
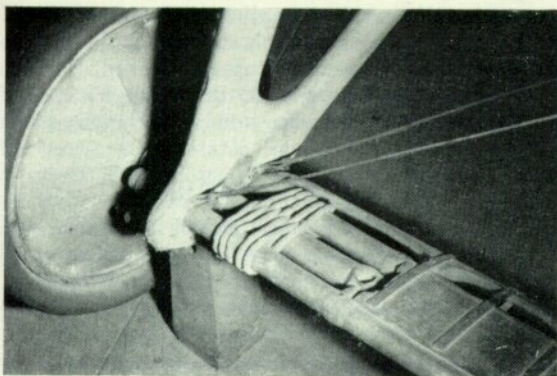
Bechereau realised that the rotary, air-cooled aero engine as exemplified by the French Gnome, Le Rhône and Clerget types, would rapidly reach its limit of development, largely because of centrifugal and gyroscopic forces becoming excessive in bigger and more powerful types. A fixed, water-

cooled engine of indigenous French production appealed to him as a basis on which to design a fighter; an engine providing at least 150 h.p. and more as development proceeded.

At around the same period German designers had also realised that however successful their Fokker monoplane had been with its rotary engine and fixed machine gun firing through its propeller with the aid of a synchronising gear, its days were numbered on performance alone. They, therefore, turned their attention to fixed engined fighters, for Germany was much more advanced than the Allies in the development of water-cooled engines, which consisted mainly of in-line, six cylinder arrangements. The appearance on the Western Front of the Albatros D.I. with a 160-h.p. Mercedes or Benz in-line engine in August 1916, at once restored air supremacy to the Germans, which they had lost to the Allied fighters during the great battle of the Somme in July 1916.

This adverse turn of the tide against the Allies proved Bechereau's design concept to be right, and as the prototype SPAD VII had flown the previous





May in the hands of Bequet, the *Escadrilles* were able to begin re-equipping with SPADS in the Autumn of 1916, just in time to counter the Albatros, threat. Britain, too, was turning to the fixed-engine formula, and had already evaluated the Hispano in a B.E.2d flying test bed in March and April 1916 at the Royal Aircraft Factory. The first S.E.5, designed around the new engine, was flown by Major Frank Gooden at Farnborough at the end of the year.

So, two new Allied fighters, the SPAD and the S.E.5, powered with the same type of liquid-cooled engine, entered the war and both survived to the end in developed variants—the SPAD XIII and the S.E.5a. Produced in large numbers by outside contractors, these fighters appeared in massive formation over the Western Front in 1918, assuming at once mastery of the skies. This superior air power did exert a decisive influence on the result of the war—victory for the Allies.

THE HISPANO ENGINE

Much of the credit for this reversal of fortunes must go to the inspiration of Marc Birkigt, designer

of the Hispano engine, which was of advanced conception for its day. Its mechanical details differed little basically from today's high efficiency piston engines. The Hispano introduced monobloc aluminium cylinders with screwed-in steel liners, and the big ends and main bearings were lined with anti-friction metal. Overhead camshafts operated the large overhead valves, and the small ends of the machined connecting rods, carrying the gudgeon pins, were fed with a share of the forced lubrication generally incorporated in the design.

The Hispano was a broad "Vee" type of eight cylinders, with the two blocks set at 90-degrees, this providing ample space for the Claudel carburettor and induction system. Dual ignition was fitted; two magnetos were located at the rear of the engine (the camshaft driving-shafts being at the front), each cylinder having duplicated sparking plugs. The Hispano had a favourable weight/power ratio, which was a great improvement on the figures of water-cooled engines up to the time of its inception, and this figure improved as the power of the unit was increased by progressive development.

L. Bechereau and H. P. Folland (the latter was



Top of page: Details of bungee undercarriage springing and cabane struts. The diagonal front strut was a production modification, added for strength.

Left: S.XIII receiving its final coats of dope and camouflage markings in the Levasseur factory. (Photo: Musée de L'Air)

largely responsible for the S.E.5) proceeded with their individual designs around the Hispano according to the latest practice in the state of the art in their respective countries. The SPAD VII was, therefore, a typically French aeroplane while the S.E.5, which went into service in April 1917, some six months after the SPAD, was a design embodying straightforward engineering highly suitable for mass production by outside contractors. Both types made their impact felt in action, and their developments, the S.E.5a and SPAD XIII, followed up the initial success by consolidating their reputation during the latter part of 1917 and in 1918.

THE SPAD XIII

The SPAD XIII first flew in early August 1917 and was powered with the 220-h.p. Hispano-Suiza 8BA in its early versions and the 235-h.p. 8BEc in later production aircraft. Both were geared engines and the distinguishing feature of the Mark XIII was the opposite rotation of its propeller to that of the earlier Mark VII. Some trouble was encountered with the gearing in the Mark 8BA engine, a development of the direct drive 150-h.p. Hispano. The S.E.5a Hispano also suffered the same troubles and Wolseley Motors redesigned the engine into the 200-h.p. direct-drive Wolseley Viper, with high compression and higher revolutions to gain extra power. But Birkigt persevered with the geared version and success was evidently achieved for engine failure in the SPAD XIII was rare.

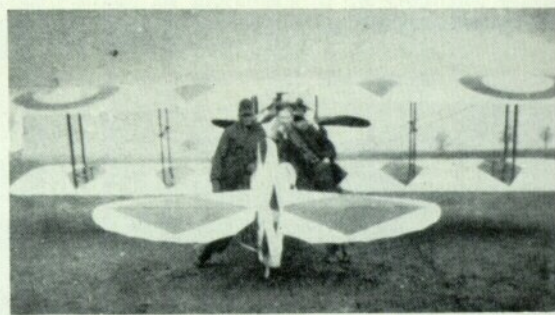
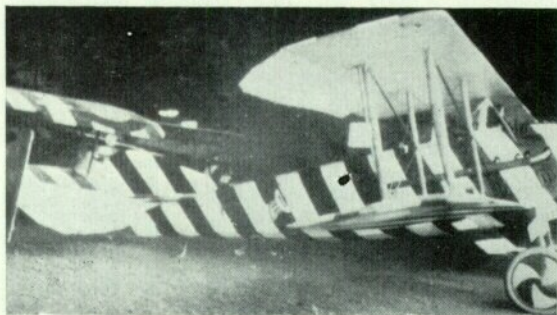
Following the SPAD XIII's first flight production mounted rapidly and the type soon replaced most of the earlier French fighters, including the SPAD VII as well as the Nieuport 28, in practically all the *Escadrilles*. The chief differences which distinguished the Mark XIII from its family predecessor were the increased size of the aeroplane, its bulkier

engine installation and cowling, the tapered chord ailerons and rounded tailplane tips. Twin Vickers machine guns mounted on top of the front fuselage in front of the pilot replaced the single Vickers of the SPAD VII. The fin and rudder were also larger.

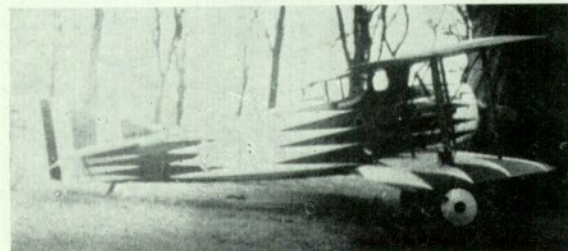
THE XIII DESCRIBED

Construction of both the SPAD VII and XIII was conventional, apart from the unique feature of interposing tie struts half-way along the wing span, to prevent the somewhat acutely-angled flying and landing brace wires from whipping and chafing in flight. This gave the SPAD the appearance of a two-bay biplane whereas, apart from the recognition aspect, it was in fact a single bay. The aspect ratio of the SPAD was greater than that of the S.E.5, and this was one aerodynamic factor which promoted the high rate of climb of the French aeroplane and the superior manoeuvrability of the British machine. Another was the high-lift wing section of the SPAD which, with ample undercamber, differed from the R.A.F. 15 section of the S.E.5, which had been developed as a high speed aerofoil, as air speeds were understood at that time.

Because of these differences in wing section the S.E.5 handled easily during aerobatics and was more stable in flight, two attributes which gave the aircraft an edge over its adversaries in the swirling dog fights. The SPAD climbed to fighting altitude faster than its British partner, and this characteristic enabled it to meet the German machines with power in hand. Evidence shows that these differences had little effect on the victory/loss ratio of both machines, and together they swept the German fighters from the skies. The SPAD was tricky to handle at low speeds and had to be flown on to the ground during landing with the engine power on, unlike the S.E.5 which could be "floated" on.



Many and varied were the colour schemes of the famous "Hat in the Ring", 94th Aero Squadron, of the World War I period, as can be seen by these photographs. Top, left to right: Black and white stripes; Lt. W. Palmer's aircraft in red and blue diamonds on white background. Below, left to right: Blue on white; Lt. J. M. Jeffers' red, white and blue S.XIII.



Another quality of the SPAD was its ability to dive at a higher rate than most, if not all, of its contemporaries, Allied or German. There was no fear of wings falling off or wing covering stripping, as happened to other types. The SPAD design of Bechereau was notable for its robust construction, a desirable attribute of a combat aeroplane, particularly a fighter which in those days of massive dog fights was thrown all over the sky, performing gyrations quite unknown in the Second World War.

The SPAD XIII construction followed general prevailing practice, that is, a wire-braced biplane with a box-section fuselage carrying the engine at the front and a tail at the rear in a structure of wooden members with metal joint fittings. The fuselage comprised four spruce longerons with spruce struts and cross-members, of square section and braced with heavy gauge piano wire, pulled tight and wrapped around thimbles at each end where they were attached to the wiring plates at the joints. This method had been discarded by British manufacturers, who used swaged steel tie rods with screwed ends attached to the wiring plates by machined fork ends and pins.

Similarly, the flying and landing wires of the SPAD were of wire cable, while British aeroplanes utilised rolled, streamlined section "Rafwires"* as typified by the S.E.5. The engine bearers of the SPAD were also quite unlike those of the S.E.5, the latter having spindled ash beams supported by thick plywood transverse bulkheads, the former featuring comparatively thin walnut panels standing vertically on their edges at the width of the engine, to which they were attached through steel angle brackets screwed to the bearers and bolted through the crankcase bearer feet. The engine bearers also continued into the cockpit to support the pilot's seat.

* Devised by the Royal Aircraft Factory, hence the designation.

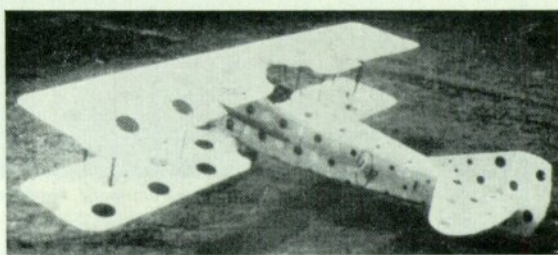
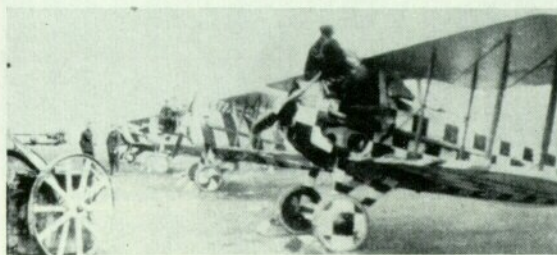
The transverse bulkheads were of heavy gauge sheet steel punctured with lightening holes, two forward and a third aft at the junction of the front of the fuselage longerons. The rear bulkhead was in three sections, as the front centre wing struts were also located at this point in addition to, at the bottom, the top of the front undercarriage struts.

Made as a one-piece structure (as in the Sopwith Camel) the upper wing had hollow box-section spars made in short sections united by scarf-joints bandaged with linen strip and doped, presumably because long runs of spruce were unobtainable in France. The wing ribs had webs of plywood with spruce capping strips, and the internal bracing was piano wire.

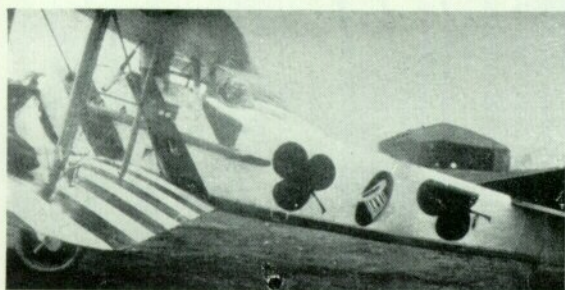
Lower wings were attached to the bottom of the fuselage by the spar ends, which mated into duralumin sockets set in the lower longerons, thickened locally in cross-section. The leading edges of all surfaces were spruce members and the trailing edges were of wire. The latter method was characteristic of the SPAD and other French aircraft of the time, and when the surfaces were covered with fabric and dope tautened a scalloped effect was produced along the trailing edges.

The trapezium-shaped stabiliser was attached to the rear fuselage by four bolts, but no provision was made for tailplane incidence trimming in flight. The rudder and elevators were hinged with eyebolts and steel rods. Undercarriage legs were carved in one piece from laminated poplar sheets glued together under pressure, and the axle was articulated at the centre, the wheels being sprung by the conventional "bungee" elastic cord, as was the steel-shoed wooden tailskid.

A car type nose radiator of an approximate circular shape with vertical "venetian" blind type shutters for temperature control, dictated the cross-section of the fuselage. This merged gradually into



Left to right: Line-up of 94th Squadron's S.XIIIs; Lt. S. Kaye's SPAD. White wings, blue fuselage and fin covered overall with red and blue spots. Below, left to right: White S.XIII with green shamrocks and stripes; Lt. Outcault's SPAD.





Emblem of the 13th Aero Squadron.

the vertical knife edge at the sternpost, a geometry followed with the aid of light fairings on the main box structure sides. Fuel was carried in under-belly tanks in the front fuselage, and was lifted to the

service tank in the centre of the upper wing by an engine-driven pump. Engine-driven pumps also supplied oil under pressure to the engine and circulated water to the radiator from a header tank, also located in the upper wing.

On the SPAD XIII the main interplane struts were of duralumin tube faired to a streamline section with spruce mouldings. Ailerons were fitted to the upper wing and were operated through a system of tubular push rods via the thickened longerons at the bottom rear spar junctions, and thence through the lower wings to the vertical push rods behind the rear outboard struts to levers on the aileron front spars. The curious tubular bell cranks at the bottoms of the rear struts were the moving links between the enclosed horizontal push rods in the lower wings and the exposed vertical push rods.

THE SPAD IN ACTION

The story of the war in the air as waged by the French fighters in 1914–1918 has been told through



Above: S.XIII of the 91st Aero Squadron, motif, knight chasing a devil. Below: S.XIII of the 213th Aero Squadron.





Capt. R. Soubiran, C.O. of the 103rd Aero Squadron, with his S.XIII. Below: S.XIIIs of the 95th Aero Squadron.

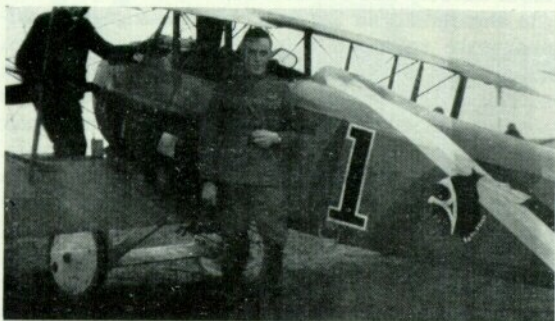
the deeds of the flying aces. Georges Guynemer was the first of these to achieve national fame, and he was the first French ace to fall while heading the table of victories. The SPAD XIII was only just entering service when he failed to return from an engagement over Poelcapelle in Flanders. He is known to have been flying one of the latest SPAD XIIIs. Although *Le Grand Chasseur* (the Great Fighter) had gone, other champions had arisen from the legion of French fighter pilots who flew SPADs.

Highest scoring ace of the Allies was René Fonck with a tally of 75 victories at the end of the war. He, like James McCudden the British ace, was a



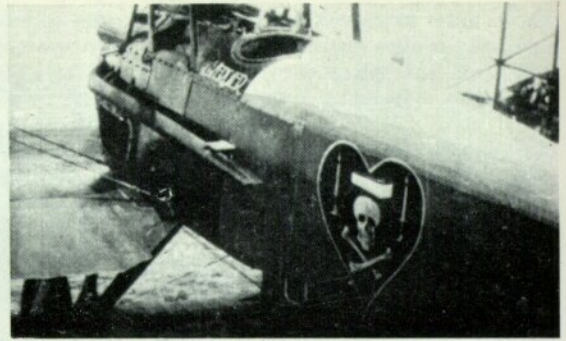
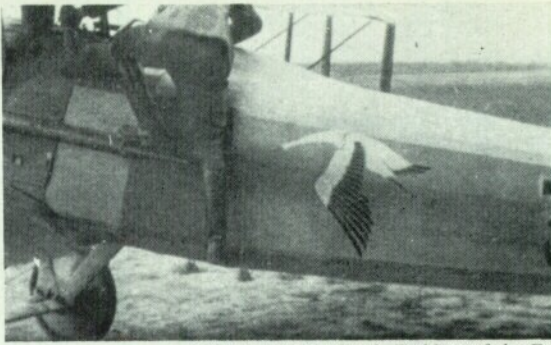
firm believer in marksmanship and also took pains to perfect his aim by ground practice. But he could not have achieved his fantastic success in action had he not been mounted on such a steady gun platform as the SPAD. Included in his score were two sixes in one day, with numerous doubles and trebles.

On 9th May 1918, he was flying his SPAD XIII on morning patrol over the Somme sector of the Front when he encountered an enemy two-seat reconnaissance aircraft and two escorting Albatros fighters. Varying times have been quoted for his rapid despatch of all three, but it was certainly a matter of minutes, or even seconds, and their wreckage was found within 400 yards of each other. During evening patrol the same day, Fonck accounted for another two-seater and its two escorting Fokkers, presumably D.VIIIs. All were flying in large formations of enemy fighters. Fonck was noted for his extreme economy of ammunition and



Striped S.XIII of the 138th Aero Squadron. Note stars on coloured fin, rudder, tailplane, elevators and cowling. Above: S.XIII of the 213th Aero Squadron.





Left and right: Stork Emblem of the Escadrille SPA 3; personal emblem of Nungesser.

on this occasion his expenditure averaged nine rounds for each victory. The second occasion he scored six in one day was on 26th September, when he shot down four Fokker D.VIIs, one Albatros D.V and a two-seater.

Third in the honours list of French aces was Charles Nungesser with 45 victories, mostly on SPADs. He was of the Albert Ball type with a complete disregard for danger and was in and out of hospital on numerous occasions. Many of his victories were obtained when flying SPAD VIIIs or XIIIIs, and it speaks well for their sturdy structure that they hung together despite tremendous battle damage.

The fourth ace in the French ranking was Georges Madon with 41 victories. He combined the deadly marksmanship of Fonck with the persistence of Nungesser, pressing home his attacks just short of ramming his opponents. Madon's highest rate of scoring was when mounted on a SPAD XIII. One of the *Cigognes* who became a really skilled SPAD operator, both with the Mark VII and Mark XIII, was Albert Deullin whose 20 victories were scored in some of the hottest fighting of the whole war, notably in Flanders, on the Somme and over Soissons. In 1918 he was in command of a *Groupe de Chasse* flying SPAD XIIIIs in the fierce and decisive battles of Chateau Thierry and St. Mihiel. Others who gained more than usual distinction on the SPAD XIII were Maurice Boyeau (35 victories), Michel Coiffard (34), and Armand Pinsard (27).

FOREIGN SPADS

Although the air service of the American Expeditionary Force saw action in World War I for seven

months only, it made an impact on the air fighting and in so doing laid the foundations of the American Air Force. A number of Americans had indeed flown with the Allied Forces before the U.S. entered the conflict, notably with the *Escadrille Lafayette*. Most of the A.E.F. aircraft were obtained from Britain or France as their own were not up to battle standard at that time. Nearly all the fighters were in fact SPAD XIIIIs, for the Nieuport 28 was discarded after a short while and replaced by the SPAD. Of the 893 SPAD XIIIIs acquired by the A.E.F. after February 1918, 435 were shipped to the U.S. after the Armistice and most were re-engined with the American-built 220 h.p. Wright-Hispano. With this engine, however, the performance of the SPAD fell away, as shown in the specification on page 12. The leading American fighter aces who used SPAD XIIIIs for most of their service flying were Edward Rickenbacker, Raoul Lufbery and Frank Luke.

In the Italian air services, 11 *Squadriglie* (squadrons) were equipped with SPAD XIIIIs, although the Italian pilots seemed to prefer the French Hanriot HD.1, a much less powerful but more manoeuvrable aeroplane which probably suited their style of fighting in the mountainous flying terrain. The leading Italian ace, Francesco Barracca, with 34 victories, scored most of these with his SPAD VII and SPAD XIII. One Belgian *Escadrille* only, the 10th, used the SPAD XIII and one Belgian ace, Edmond Thieffry, won fame on the type. R.F.C. Squadrons Nos. 19 and 35 were equipped with the SPAD VII but no use appears to have been made of the Mark XIII, although a footnote in the British official history of the War in the Air seems to indicate that 19 Squadron may have had them for a short while, pending delivery of British types.



S.XIII of the Escadrille SPA 48.

S.XIII, Escadrille SPA 48



SPA 48 motto.
'Chant et Combat'



S.XIII, French Naval Air Service, Dunkirk, 1918 ↓



French Navy Insignia



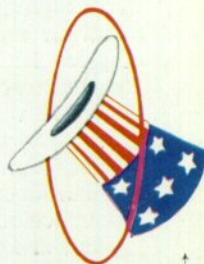
27th Aero Squadron



S.XIII, 94th Aero Squadron, American Expeditionary Force, flown by Capt. Eddie Rickenbacker →



S.XIII, 27th Aero Squadron, A.E.F., flown by Lt. Frank Luke ←



94th Aero Squadron ↑



S.XIII, 27th Aero Squadron, A.E.F., flown by Lt. Frank Luke ←



← S.XIII, Italian Air Force

Red Heart



→ S.XIII, flown by Maj. Francesco Barraca, Italian Air Force.



'Cavallino Rampante', emblem of Maj. Francesco Barraca



S.XIII, Belgian Air Force

© WARD



France



A.E.F.



Italy



Italy



Belgium



SPAD XIII in Czechoslovakian national insignia.

(Photo: Pavel Vancura)

CAMOUFLAGE SCHEMES

The variations of French camouflage patterns during 1917 and 1918 have been somewhat obscure. When colour protection was adopted early in the war as protection against air observation a comparatively simple scheme of large irregular patches of green and brown was adopted, with grey nose and undercarriage, under-surfaces being left natural dope and varnish finish. This form persisted until 1917 was well advanced, when a multi-colour scheme of irregular patches, usually five colours, was introduced, thus copying the German example of multi-colour but not the pattern.

The SPAD XIII shown in the five-view drawing is one supplied to the Americans finished in a 1918 colour scheme and it went to the 22nd Pursuit Squadron. It won six victories, hence the bullet hole black patches! It is now in the National Air Museum in Washington, D.C. The SPAD XIII in *Le Musée de L'Air* at Chalais-Meudon near Paris is painted in a bizarre colour scheme which was either

an interim scheme or perhaps the creation of a painter-rigger in the field! It is certainly the original scheme as it was faithfully copied when the aircraft was restored and repainted some while ago, according to the Musée authorities, to whom thanks are due for valued assistance in the compiling of this *Profile*.

The SPAD XIII remained in service in the French forces until 1923, 37 were delivered to Belgium after the Armistice of November 1918, and the 435 airframes which went to the United States Army Air Corps were fitted with Wright engines. Other countries including Japan bought SPAD XIII's in small numbers for their emergent air forces after the war.

© C. F. Andrews, 1965

SPECIFICATION

Span: 26 ft. 3½ in. (both wings in later production).
 Length: 20 ft. 4 in. Height 7 ft. 6½ in.
 Wing Details: Chord (upper) 4 ft. 7½ in. (lower) 4 ft. 5 in.
 Gap 3 ft. 10½ in. Stagger 1½ degrees. Incidence (upper) 1½ degrees (lower) 1 degree. Sweepback nil. Dihedral nil.
 Area 227 sq. ft. Loading 8 lb./sq. ft.
 Power Unit: 220 h.p. Hispano-Suiza 8BA (1917). 235 h.p. Hispano-Suiza 8BEc (1918).
 Power Loading: 8.2 lb./h.p.
 Fuel Capacity: 30 gall. petrol. Oil Capacity 4½ gall.
 Armament: 2 Vickers .303 fixed machine guns.
 Weights: (official French figures). Empty 1,245 lb. Petrol, oil, water 242 lb. Military load (incl. pilot) 320 lb. Total 1,807 lb.

Performance (Report No. 5)

Aeronautique Militaire, *Ministre de la Guerre*, 1917

Metres	Feet	Climb (mins.)	Speed	
			km.hr.	m.p.h.
500	1,640	0-55	—	—
1,000	3,281	1-55	—	—
2,000	6,562	4-40	215	133.5
3,000	9,843	7-50	214	132.8
4,000	13,124	12-10	209	129.8
5,000	16,405	18-30	203	126.1

(Note: With 8BA engine—with 8BEc highest speed 138 m.p.h.)

Duration: 2 hours. Range 200–250 miles according to operational sortie.

Performance of American Air Corps SPAD XIII with 220 h.p. Wright-Hispano at A.U.W. of 2,036 lb. Speed at sea level 131.5 m.p.h. Speed at 6,500 ft. 128.0 m.p.h. Climb to 6,500 ft. 6.5 mins.

Production: SPAD 1,141, Blériot Aero. 2,300, Bernard 1,750, Kellner 1,280, Nieuport 700, Borel 300, Levasseur 340, Soc. Constr. A.P. 300, A.C.M. de Colombes 361, Total 8,472.



Above: S.XIII of the Italian Air Force. Below: Japanese S.XIII.

