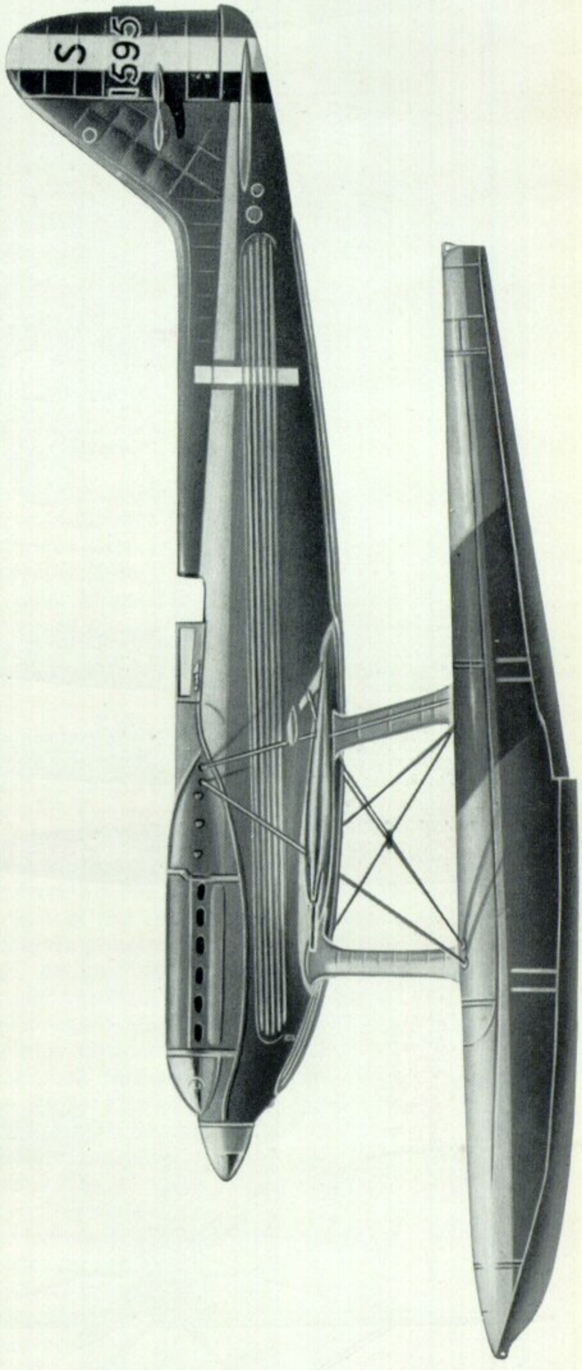
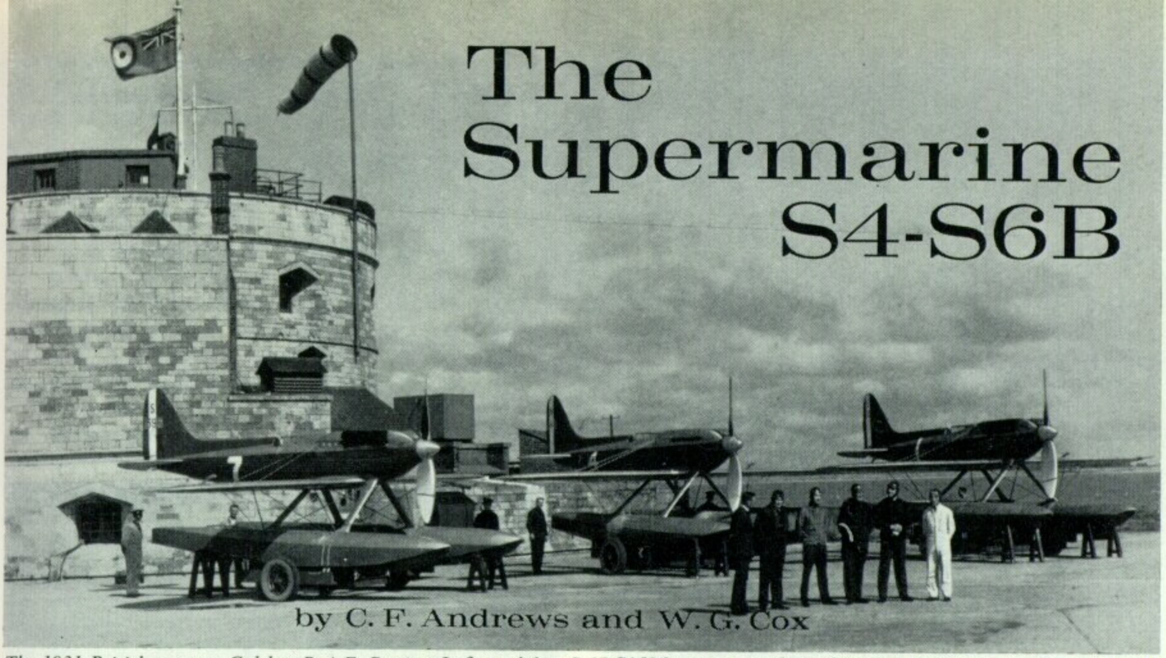
PROFILE PUBLICATIONS

The Supermarine S4-S6B



NUMBER 39

The Supermarine S4-S6B



by C. F. Andrews and W. G. Cox

The 1931 British team at Calshot R.A.F. Station. Left to right: *S.6B* S1596 *reserve machine, S.6A* N247 *training machine converted from 1929 winner, S.6B* S1595, *outright winner of the Schneider Trophy for Britain.*

The Schneider Trophy International Contest for Seaplanes was originally intended to encourage the development of aircraft which could use the sea as an aerodrome. At the first international meeting for seaplanes held at Monaco in 1912 it was evident that they were far behind contemporary landplanes in technical progress. To foster their progress M. Jacques Schneider donated a trophy bearing his name for a contest which included a speed trial over a closed circuit of several laps. The first Schneider Contest was held at Monaco in 1913 and, with breaks caused by W.W.I. and for other reasons, was held intermittently until 1931. In that year the Trophy was won outright by Great Britain, who had triumphed in three successive races. This triple success was achieved by the S series of Supermarine racing seaplanes designed by Reginald J. Mitchell, whose genius became even better known later as the originator of the Spitfire, immortalised in W.W.II. This *Profile* deals with the Supermarine S.4 of 1925, the S.5 which won the 1927 contest, the S.6 which was the 1929 winner and the S.6B, which wound up the whole series of Schneider Contests by capturing the Trophy for good in 1931.

Mitchell had indeed four Schneider winners to his credit, for the Supermarine Sea Lion II flying boat had gained a surprise victory in the 1922 Contest held at Naples, thus preventing the Italians from recording three wins in a row. The Italians likewise saved the Trophy in 1926 when de Bernadi scored a resounding win in the Macchi M.39, the Americans thus failing to capture the Trophy outright after two successive wins. The 1926 Contest, held at Hampton Roads, Newport, U.S.A., was remarkable in another way. For the first time since the first Contest in 1913 was won by Prevost on the Deperdussin racer, a monoplane provided the winner, all the intervening successful types being biplanes.

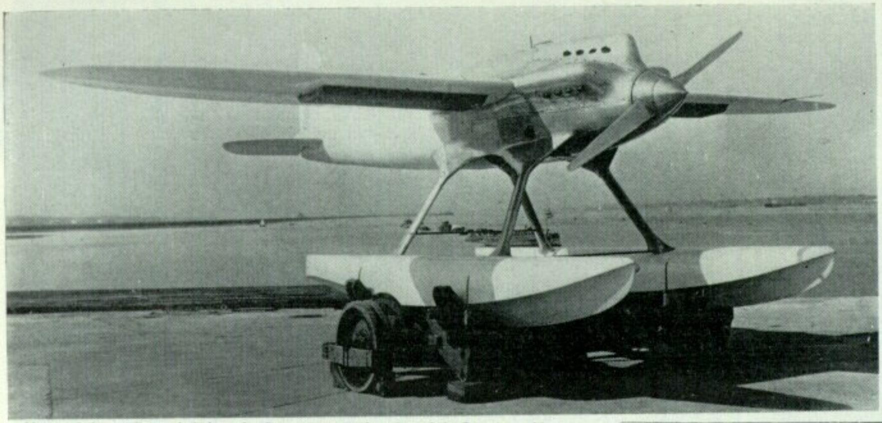
Mitchell had been the first designer to revive the monoplane configuration in the racing seaplane, for his revolutionary S.4 entered for the 1925 Contest at Baltimore drew attention to the virtues of the type, especially aerodynamic, notably that of drag reduction. Actually Mitchell went a little beyond the state of structural knowledge at that time and the S.4, after setting up new speed records, crashed during the qualifying trials and was lost.

THE SUPERMARINE S.4

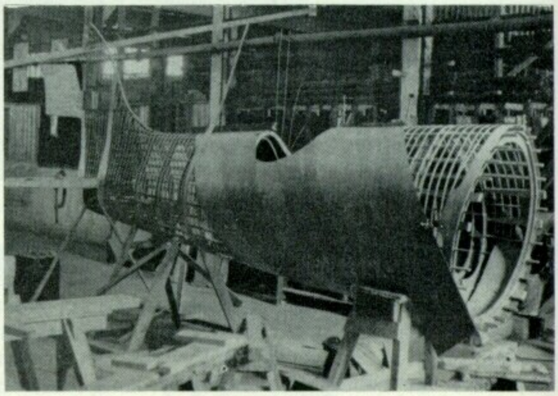
The design of the Supermarine S.4 was the direct result of the successful challenge of the Americans in the 1923 Contest held at Cowes, Isle of Wight, when two U.S. Navy Curtiss C.R.3 floatplanes filled the first and second places, beating by a wide margin the Supermarine Sea Lion III flying boat, a cleaned-up version of the 1922 winner at Naples. The Curtiss machines presented an exceptionally clean and compact design, innovations including wing surface-mounted radiators, an all-metal propeller and the new liquid-cooled Curtiss D.12 engine, installed in a carefully streamlined nose.

Mitchell realised that the small flying boat was obsolete for high speed conditions and began to devote a considerable amount of thought and time to the new problem confronting him, if he was to repeat his Naples success. The S.4 was his answer and it was as startling when it first appeared as the Curtiss C.R.3 had been. The feature that made the new Supermarine design so outstanding was that the wing, float chassis and tail unit were complete cantilevers. No bracing wires were used at all. The British Government supported the construction of the S.4 by agreeing to purchase the aircraft if the engine and airframe manufacturers shared the initial cost of building.

A decision was made by the Supermarine and Napier Companies to go ahead on the 18th March 1925 and the S.4 made its first flight on 25th August



The S.4 contender for the 1925 Contest showing its cantilever construction.



The monocoque fuselage of the S.4 under construction.

piloted by Henri Biard, Supermarine's chief test pilot. To design and build such an aircraft in five months was a great achievement and set the pattern for the Supermarine racers then to come.

The monoplane wing was made in one piece with normal front and rear spars of spruce flanges and plywood webs with a number of spanwise stringers re-butted into wing ribs, which had spruce flanges and ply webs. This structure was then covered top and bottom with plywood sheeting gradually increasing in thickness from the tips to the centre line of the wing. A trough was built on the undersurface of the wing to carry the water coolant pipe from the engine to the Lamblin type radiators located under the wing. These radiators were the only protuberances on the whole machine. An interconnected flap and aileron system was introduced, the ailerons being able to act independently or in conjunction with the flaps. Oddly enough, flaps were not used by Mitchell on any of his succeeding Schneider racers.

The fuselage was built in three sections; the engine mounting, the centre and the rear monocoque. Apart from steel fittings and the two "A" frames of steel tubing, which comprised the backbone of the centre body, the S.4 was constructed entirely in wood. It was interesting to note the resurrection of the monocoque fuselage after a lengthy gap in time, for the Deperdussin winner of 1913 also used that type of streamlined body. The floats were attached to the bottom of the two sloping "A" frames, the one-piece wing passing between the frames and were attached to them, while the engine mounting was attached to the forward frame.

A special version of the Napier Lion 12-cylinder, water-cooled engine of the "broad arrow" configuration was developed to produce 700 h.p. for the short period of the race. This brief life, in fact, was a general characteristic of Schneider engines, particularly those that came later. The Lion had direct drive to the propeller and starting was by a Bristol gas starter unit. The propeller was an all-metal, Fairey-Reed type.

The floats, of the single-step type, were of wooden construction closely following the design of the Supermarine flying boats, that is, a fore-and-aft keel member along the bottom centre line with port and starboard chines, the three members forming the pronounced "Vee" underside of the floats. Double watertight bulkheads were provided and the whole structure was flexible enough to absorb a very considerable amount of punishment in rough water conditions.

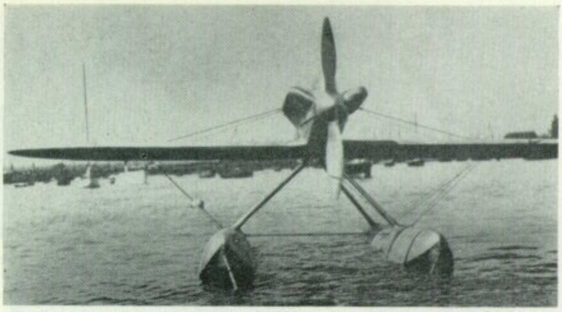
Left: *The S.4 on the slipway works at Woolston, Southampton.* Right: *Capt. Biard leaving the primitive slipway at Baltimore for trials just before the S.4 crashed.*

The fuel and oil systems were conventional except that the petrol had to be carried in several tanks, there being insufficient room for a single unit. The oil cooler was located on the underside of the fuselage, only the cooling fins being exposed to the airstream.

Flying trials were conducted from Calshot air station, the Royal Air Force rendering invaluable help and making possible the expeditious conclusion of the test period, which included the setting up of new records. The S.4 was not a good aeroplane from the pilot's point of view, as the position of the wing in relation to his eyeline during take-off and alighting created a hazardous blind spot.

Before the S.4 was sent to the U.S.A. for the eighth Schneider Contest at Baltimore in 1925 a speed test was conducted over a straight course along Southampton Water during which it captured the World Air Speed Record for Seaplanes and the British Air Speed Record at 226.75 m.p.h.

The subsequent history of the S.4 and of the 1925 British Schneider team was one of misfortune. The liner carrying the team encountered severe storms and Capt. Henri Biard, the Supermarine pilot, slipped during one of these and sustained a sprained wrist. On arrival in the U.S. the British entries were housed in canvas hangars and during more bad weather one of the tent poles broke and fell across the tailplane of the S.4, causing damage. This was quickly repaired and test flying began. It then confirmed what had in fact been suspected in England that the cantilever wing was subject to flutter, a phenomenon of which little was understood at that time.



Head on view of S.5 disclosing offset starboard float and extremely small cross-sectional area of fuselage with faired engine banks.

S.5 N220 *during mooring tests preceding the 1927 Contest at Venice.* (Flight photo)

F/Lt. Worseley on the S.5 with direct drive Lion racing neck and neck with F/O Kinkead on the geared Gloster IV during the 1927 Contest at the Venice Lido. The immense crowd in the foreground were very near the competing aircraft. (Flight photo)

This proved to be the undoing of the S.4 for during the mandatory taxiing and alighting trials the machine developed flutter when airborne. Capt. Biard lost control with the result that it fell into the sea and was wrecked, the pilot escaping without injury after being submerged. A hurried attempt to substitute the second Gloster III, to be flown by Bert Hinkler, also ended in disaster, the float chassis collapsing in a final attempt to pass the preliminary tests in bad conditions. This Contest was won by Lt. Jimmy Doolittle of the U.S. Army at 232·573 m.p.h., Hubert Broad being second on the Gloster III first string at 199 m.p.h.

THE SUPERMARINE S.5

The S.4 had been designed and built as an ideal. The S.5, its logical development, embodied all the hard lessons learned from the S.4 and other comparative aircraft. It could be fairly described as an exercise in aerodynamic efficiency.

F/Lt. Worseley's S.5 N219 *under tow at Venice for the 1927 contest.* (Flight photo)

Left: *The scoreboard at Venice in 1927 disclosing the better times of the British contestants.* (Flight photo)
Right: *F/Lt. Webster, R.A.F. crossing the finishing line at Venice in the S.5 thus winning the Schneider Trophy Contest of 1927.* (Flight photo)

Before the design of the S.5 could be put down as a paper project, an extensive programme of model research was carried out in the wind tunnels of the Royal Aircraft Establishment and the National Physical Laboratory. These tests were requested by the Air Ministry late in 1925 and were conducted on three-quarter scale models evolved from experience with the S.4 and the Gloster III.

The models comprised approximations of a standard fuselage, tail unit and floats, the main differences being in the wing and bracing arrangements. The first model had a low wing, braced by "W" formation struts and a tie strut between the floats. In the second model the two outer struts and tie strut were replaced by wire bracing. In the third model the high wing blended into the cylinder banks (like the contemporary Gloster IV) and braced in a similar manner to the first model. The object of the tests was to obtain data for estimating the performance of the S.5 and they were entirely successful, being within one per cent of the full scale figures ultimately achieved.

Pitching control problems of the proposed offset floats were also studied and these researches, with similar problems on the Gloster IV and the Short-Bristol Crusader, contributed a great deal to the technical achievements of the 1927 Schneider Contest. Model two suggested the most efficient system and this was incorporated in the design of the S.5, Mitchell having abandoned for the time being his cantilever wing.

While the model tests were proceeding, the High Speed Flight of the Royal Air Force had already been formed and were training at Felixstowe on the Gloster III and later on the Crusader. Meanwhile the Government order for seven Schneider aircraft had been confirmed, in the guise of fostering research into high speed flight, which later proved, more by accident than design, to have been an inspired decision when the end product was the winning of the Battle of Britain in 1940.

Experimental flying was intensified to investigate geared and ungeared engines, various propellers, cockpit fume problems and so on. All this testing, wind tunnel, model and full scale flying, proved extremely useful and the fact that the British Schneider entries for the 1927 race never required extensive modifications testified to the success of planning that went before.

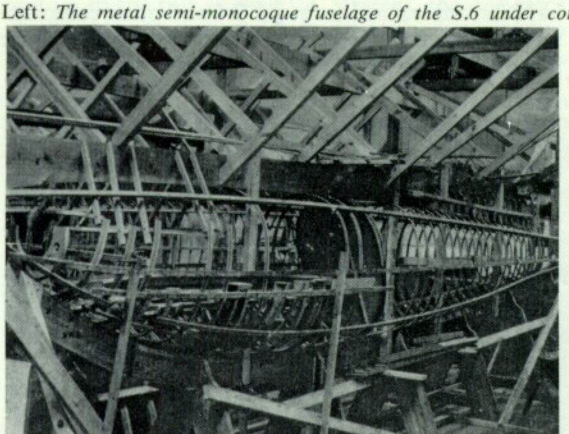
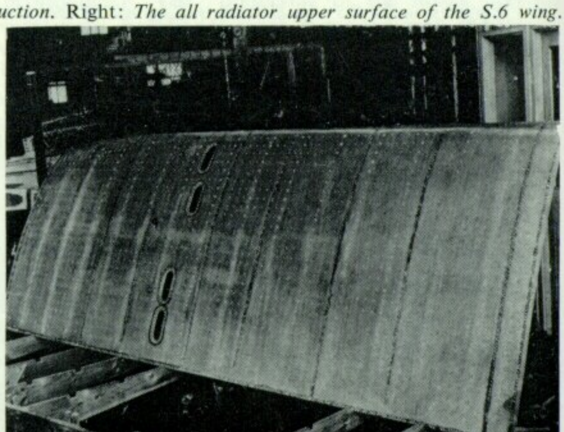
The main lines of advancement in the S.5 were aerodynamic, as previously stated.

They comprised the following items:

1. The adoption of flush wing radiators for the water cooling of the engine; this provided the necessary cooling area and reduced drag.
2. The lowering of the wing, as compared with that of the S.4, to the bottom of the fuselage; this gave a better view to the pilot than that of the S.4 and a better angle to the bracing wires than a mid-wing arrangement.
3. The adoption of streamline wire bracing between floats, wing and fuselage.
4. Smaller cross-section of fuselage and floats to reduce drag.
5. An engine of greater power output, geared to give a more efficient propeller and therefore a better thrust/power factor.

To achieve these advantages a number of unusual

Left: *The metal semi-monocoque fuselage of the S.6 under construction.* Right: *The all radiator upper surface of the S.6 wing.*

constructional features were incorporated in the design to meet the special conditions anticipated in this high-speed aeroplane.

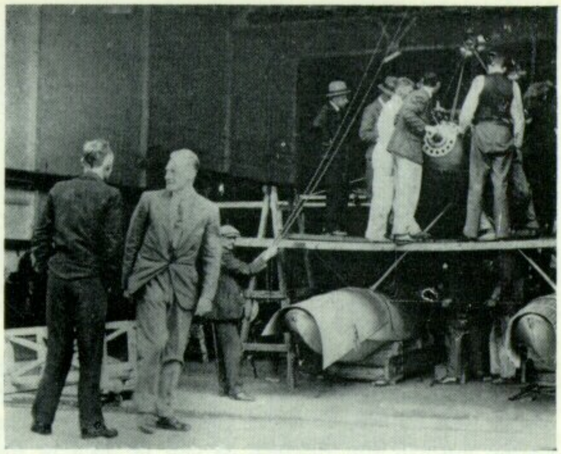
S.5 CONSTRUCTION

The fuselage was built entirely of metal, mainly duralumin, and was of simple semi-monocoque form. It consisted of 32 closely spaced formers of flat "U"-shaped section with outward turned flanges to which the skin plating was attached, thus dispensing with longerons. The forward portion comprised a scoop-shaped engine mounting, stiffened by the engine bearers, with cross bracing between them. At the rear of this assembly, the main frame, which carried the supports for the wing spars, forward floats struts and wing bracing, isolated the engine compartment from the rest of the fuselage.

With this type of semi-monocoque structure it became possible to keep the cross-sectional area of the fuselage down to a minimum. The pilot sat on the floor and his shoulders touched the cockpit coaming so that the only space lost was the thickness of the skin. The fin was integral with the rear fuselage with slightly heavier frames for the rudder post and tail-plane spars. In the most heavily loaded areas the maximum of three thicknesses of 18g. plating was adequate.

Duralumin was also used in the construction of the floats, except the fuel tank, which was of tinned steel and was assembled as an integral part of the standard float. The floats, which were of the single-step type, followed the Supermarine system of hull construction for their flying boats, that is, with a central longitudinal keel member and chines with transverse frames stabilised fore and aft by stringers. The lower ends of the chassis struts were built rigidly into the floats and were reinforced where they left the floats, at which point they were subjected to heavy bending loads.

The wings of the S.5 were of conventional wooden construction, made in two halves on the normal two-spar principle, with ribs of three-ply spruce with wide flanges to secure the screw fixings of the wing radiators in addition to the three-ply wing covering, which was $\frac{3}{32}$in. thick. From the wire bracing attachments on the rear spar a diagonal member ran outwards to the front spar to stiffen the wing against torsion, thus reducing the possibility of wing flutter. Wire bracing fork ends, etc., were entirely enclosed and flush fitting doors were provided top and bottom to give access for rigging and inspection.



Installing the Rolls-Royce "R" engine in the S.6 with R. J. Mitchell facing camera in foreground.

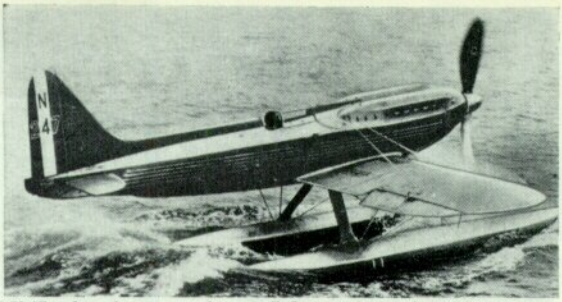
The wing radiators were placed over the wing skin and screwed to the three-ply covering. The engine cooling system was ingenious; the hot water passed from the engine into the header tank mounted behind the central cylinder block of the Napier engine. Piping then took the water along the rear edge of the radiators (located on the top and bottom wing surfaces) whence it flowed through them across the wings to the leading edge, where return piping took it back as cooled water to the engine.

The radiators were of 30g. copper sheet and covered almost the whole of the upper and lower wing surfaces. Each was built in sections $8\frac{1}{2}$ in. wide and consisted of two copper sheets rolled to the wing formation and sweated together. The outer sheet exposed to the air flow was smooth but the inner was corrugated to form the transverse water channels. Water troughs were sweated to the leading and trailing edges of each radiator to form the main flow and return channels and each radiator was detachable for repair without disturbing the rest of the system.

Oil cooling was provided by corrugated coolers of 26g. tinned steel 11 ft. long mounted along each side of the fuselage. Oil passed from the engine through one cooler into a filter, then into the oil tank (located behind the pilot) and thence back through the other cooler to the engine.

The tailplane, elevator and rudder were of orthodox wooden construction, covered with plywood. All control rods and levers (except aileron control) were enclosed for all moving surfaces and extreme care was

Left: *Launching the winning S.6 at Calshot for 1929 Contest tests.* (Flight photo)
Right: *Lighter-borne S.6 being taken out for trials in the Solent in 1929. The aircraft was slid into the water when reaching the starting line.*



N247, *the ultimate, taking off for trials in the 1929 Contest, held off Ryde, Isle of Wight.*

taken in the design to avoid any protuberances whatever. Even the cylinder block covers of the Lion engine were tailored to match the streamlining of the engine fairings and fuselage as can be seen in the head-on views of the S.5 photographs. The maximum cross-sectional area was 5·9 sq. ft. which was about as low as has ever been achieved in a racing aeroplane in this class.

Because of this small cross-sectional area and the C.G. requirements the problem of fuel storage was very difficult. It was finally overcome in a practical and simple manner by storing a part of the fuel in the starboard float. This arrangement brought bonuses by way of lowering the C.G. thus improving stability in the air and on the water and in balancing engine torque during take-off and to a certain extent in the air.

On the first S.5, *N219*, the starboard float containing the fuel tank was made longer than the port, but flying and taxiing tests proved that this extension was unnecessary for the two other S.5s. The starboard float was offset 8 in. farther from the aircraft centre line than the port on all three machines.

There was the usual race for the designers, pilots and engineers but on this occasion the British team went to Italy more confident and better prepared than in any previous Schneider contest. Most of all, the Government of the day had been right behind the enterprise, for as has already been said, the fruits of it were then unseen but made a great impact on the future in a more deadly contest.

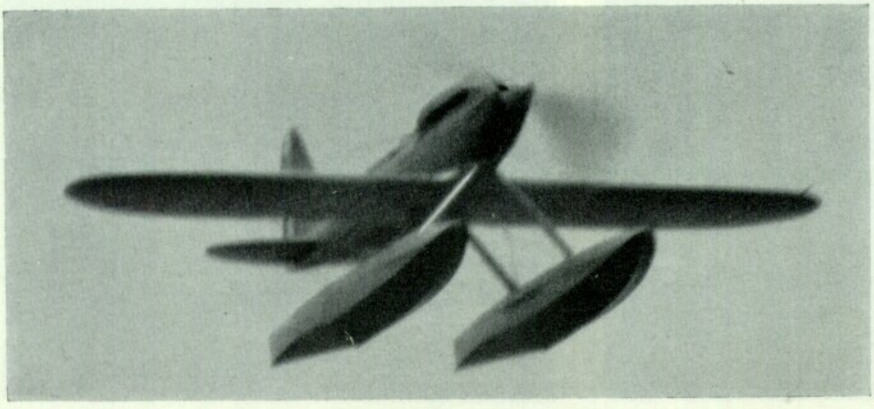
In this *Profile* there is only space to describe the performance of the S.5s in the 1927 race, held over the Lido at Venice on a triangular course of seven laps, a total distance of 190 miles. In the event this turned out to be one of the finest air races ever held and certainly the most spectacular, for the aircraft roared low along the beach on each lap in full view of and close to the enormous crowd, estimated in many hundreds of thousands. Italian machines suffered one disaster after another leading to retirements from the race but the British entries, two S.5s and one Gloster IV, lapped consistently until the sixth lap when F/O Kinkead had to retire on the Gloster after losing his propeller spinner and experiencing engine vibration.

The two S.5s completed the course, F/O S. N. Webster being the winner on the S.5 *N220* with the geared Lion engine at an average speed of 281·65 m.p.h. while F/Lt. Worseley was second on S.5 *N219* with the direct drive Lion at 273·01 m.p.h. This victory was hailed by the whole of the British Press and re-established the supremacy of British aircraft design. Both the slower S.5 and the Gloster IV averaged 7 m.p.h. better than the best lap speed of the Italian Macchis and justified all the painstaking research, development and training that had preceded the actual event. It reflected great credit on the designers, and engineers, including the engine people, and on the Royal Air Force team of pilots and mechanics.

THE SUPERMARINE S.6 AND S.6B

Enthusiasm in official circles soon waned after the resounding British win in the 1927 contest but the Royal Aero Club, who were responsible for the British entries, managed by a remarkable piece of astute diplomacy to extend the period between races to two years, to the satisfaction of the *Federation Aeronautique Internationale* (the organising body) and the other competing countries. Everyone felt by that time that the original period of one year was inadequate to prepare suitable aircraft capable of beating existing times, as complexity in design and development was beginning to become painfully evident. In addition it gave the Club time to soften up Government opinion into agreeing to spend the money on a 1929 entry.

Consequently Italy, France and the U.S. were making strenuous efforts to recapture the Trophy and considerable improvements would be needed if Britain was to retain it. The Napier Lion was nearing the end of its development and R. J. Mitchell was looking for an engine of greater horsepower. Sir Henry Royce, after deliberation with his colleagues of Rolls-Royce, eventually guaranteed an engine of 1,500 h.p. and around this Mitchell started



F/O Waghorn, R.A.F. winning the 1929 Schneider Contest over the Spithead course on S.6 N247.

designing the Supermarine S.6. This was his first all-metal racer and was a logical development of the S.5.

The new Rolls-Royce "R" engine was a development of the 36 litres capacity "Buzzard" and the enormous power obtained with this unit was obtained by fitting racing superchargers, introducing a much higher compression ratio (made possible by using chemical fuels devised by F. Rodwell Banks of the Associated Ethyl Company) and greatly increased engine operating speeds. A convergent-divergent air flow into the carburettor facilitated a reduction in kinetic energy which produced a gain in the pressure energy of the mass air flow into the engine, which mass itself was enormous. All this technological advance produced a racing engine which gave 1,900 brake horse power at 2,900 r.p.m. and weighed only 1,530 lb., a remarkable achievement in piston engine development and, as it turned out, a world beater.

For the 1931 Contest the power was further increased of the "R" engine to the stupendous figure of 2,350 b.h.p. a result obtained by increasing the engine speed, the supercharger gear ratio and the size of the air intake. The engine speed at this power rating was 3,200 r.p.m. and the weight was 1,630 lb. or 11 oz. per horsepower.

Although the continued success of British machines in the two final Schneider contests was obviously due in great measure to the Rolls-Royce engine and the more sophisticated approach to the problem of greatly increasing power than that of the Italians or Americans (who tried to reach the same end by increasing cubic capacity), the aircraft designer had to make full use of the advantage conferred upon him.

As the Rolls-Royce engine was so much bigger and heavier than the Napier Lion the S.6 was also bigger than the S.5 and weighed fully loaded 5,771 lb. as against the 3,250 lb. of the S.5. Nevertheless the percentage weight of the wings and other components was reduced by careful design. The general concept of the S.6 was basically the same as the S.5, which in the light of aeronautical knowledge at that time, had proved right. The wings and all tail surfaces were metallised (almost wholly duralumin) but still retained the conventional two-wing spar construction and ribs comprised of diaphragm webs with large lightening holes and flanges of extruded angle section. The wing radiators were built up from 24g. duralumin sheets riveted together with spacers $\frac{1}{16}$ in. thick, which pro-

S/Ldr. Orlebar descending from the S.6 after capturing the World Air Speed Record.

vided the water cavity. The radiators were screwed to the wing structure and thus formed the wing surface.

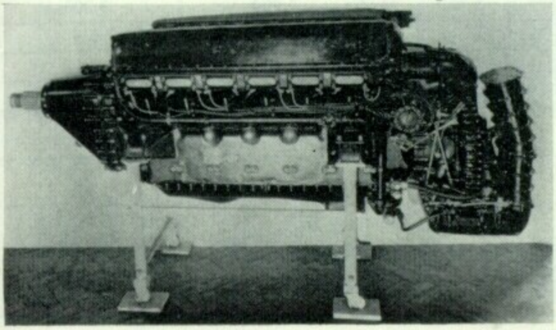
Semi-monocoque construction was used for the S.6 fuselage as in the S.5 but there were 46 frames 6 or 7 in. apart. The only longitudinal members were the engine bearers which were of 14g. duralumin angle section and ran right back along the body following the fuselage contours. The whole fuselage with the fin was skinned with duralumin sheet.

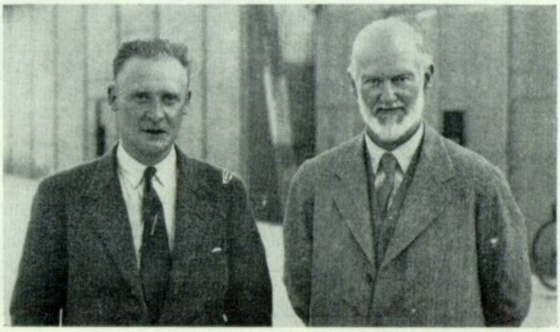
With a thirsty engine like the Rolls-Royce "R" it became necessary in the S.6 to use centre portions of both floats as tanks. The float construction was similar in detail to the S.5. In the S.6, part of the front top surface of each float accommodated an additional radiator, but in the S.6B, so great was the area required for the dissipation of engine heat (some 40,000 B.T.U.s per minute), that all the top surfaces of the floats were used down to the chines. In the S.6B considerably more fuel was carried in the starboard float to balance the enormous engine torque.

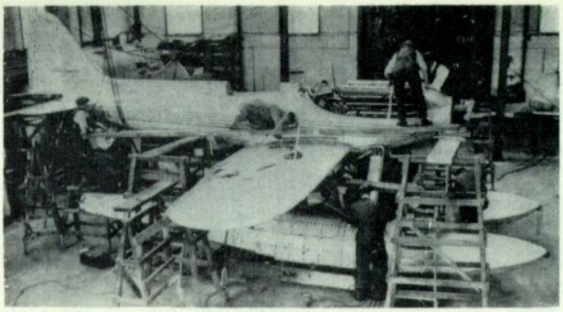
To obtain the maximum efficiency with a fixed pitch propeller, the aeroplane required just sufficient excess thrust to overcome air and water resistance at take-off. Otherwise propeller efficiency at top speed suffered. For this reason the take-off of the S.6 had been difficult and, to improve this model, water tank tests were conducted on the S.6B floats, with the result that air resistance was greatly reduced as well as the "hump" water resistance. The stability of the floats on the water was also improved.

The special propeller of smaller diameter designed by the Fairey Aviation Company for the S.6B proved unsatisfactory as the aircraft refused to take off under full power, swinging violently to port under full opposite rudder. Eventually a compromise between

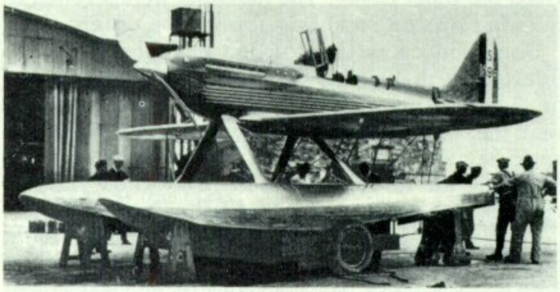
Left: *The Rolls-Royce "R" engine of 1929 and 1931.* (Science Museum photo) Right: *Reginald J. Mitchell (left) and Sir Henry Royce—architects of the 1929 and 1931 Schneider victories.*



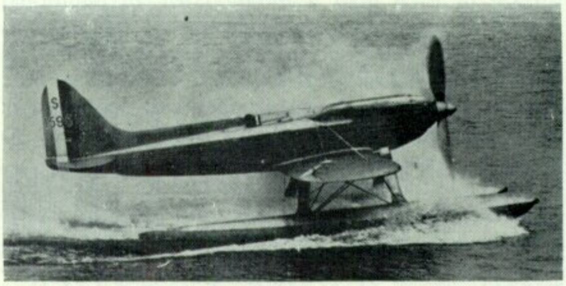




S.6B under construction and final assembly at Woolston in 1931.



Close-up of S1595 *at Calshot in 1931.*



S.6B S1595 *taking off in the Solent, 1931.*

the S.6 and S.6B propellers was arrived at which proved satisfactory. The method of take-off was to aim the nose several points out of wind and gradually turn into it as the speed picked up. The stick was held hard back into the pilot's stomach and kept there until the unstick when the S.6 and the S.6B became quite tractable aircraft at high speed.

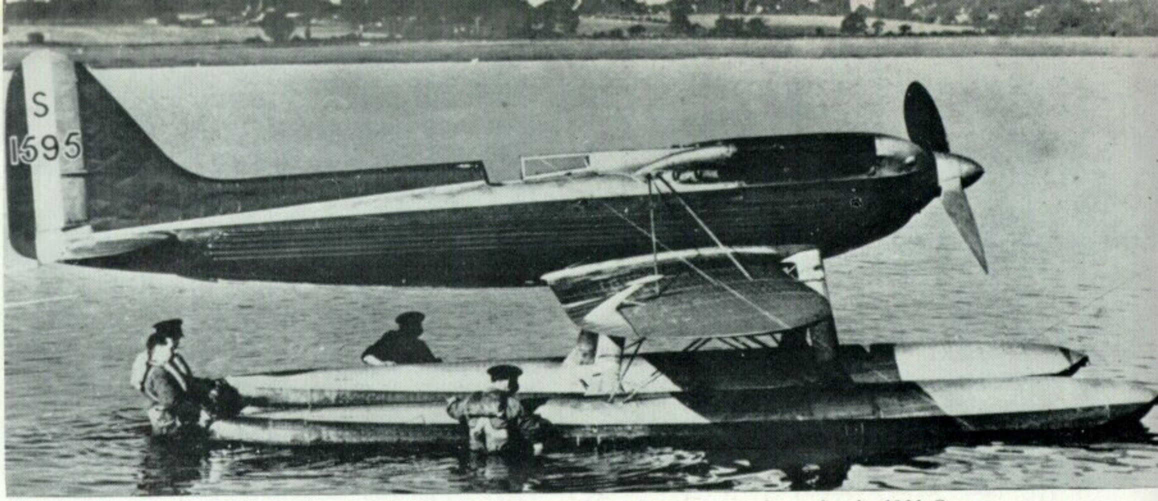
A special oil cooling system had to be devised for the high power "R" engines, as engine temperature was critical. In fact, the races had to be flown at a maximum temperature and this was the deciding factor for the pilot in finding out how far he could open the throttle. The hot oil passed along the fuselage coolers (similar to S.5) to the top of the fin whence it ran down the insides of the fin skin via ribs and gutters to an integral tank with a filter and thence by the return cooler under the fuselage back to the engine. Small vanes placed in the cooler oilways kept the oil in contact with the outer surfaces and this method, arrived at after much experiment, increased the efficiency of the oil cooling system by 40 per cent.

Control surface flutter had been experienced with the S.5 and again with the S.6, so on the S.6B mass balances were added to control surfaces to eradicate this tendency. To avoid unwanted loading on the control column and rudder bar caused by small inaccuracies of construction, the elevators and rudder of the S.6B were fitted with small trim tabs to suit the characteristic of each individual aircraft.

The story of the S.6 and the S.6B in the Schneider Contests of 1929 and 1931 can be briefly told. F/O H. R. D. Waghorn won the 1929 Contest, held off Ryde, Isle of Wight, in the S.6 *N247* over a quadrilateral course of 50 milometres covered seven times, at an average speed of 328·63 mp.h. F/O R. L. R. Atcherley came in second on the other S.6, *N248*, at 325 m.p.h. but was disqualified for missing a turn. Two weeks later S/Ldr. A. H. Orlebar took the World

ENGINE DATA
(From Napier and Rolls-Royce Records)

Type and Designation	Napier Lion 12-cylinder Broad Arrow VII (Direct Drive)	Napier Lion 12-cylinder Broad Arrow VIIA (Direct Drive)	Napier Lion 12-cylinder Broad Arrow VIIB (Geared)	Rolls-Royce "R" 12-cylinder Vee (Geared and Supercharged)	Rolls-Royce "R" 12-cylinder Vee (Geared and Supercharged)
Year	1925	1927	1927	1929	1931
Bore	5·5 in.			6 in.	
Stroke	5·125 in.			6·6 in.	
Capacity	24 litres (1,476 cu. in.)			36·7 litres (2,240 cu. in.)	
Dry Weight (lb.) ...	750	850	930	1,539	1,640
B.H.P.	680	900	875	1,900	2,350
R.P.M.	2,600	3,300	3,300	2,900	3,200
Compression Ratio	8/1	10/1	10/1	6/1	6/1
Boost (lb./sq. in.) ...	Nil			13	18
B.M.E.P.	142 (estimated)	148 (estimated)	144 (estimated)	225	254
Fuel Consumption (pt./h.p./hr.) ...	·04	·046	·046	·6	·6
Oil Consumption (gall./hr.) ...	8	8	8	10	14
Engine Nos. ...	E.74	E.86	E.90	1, 3, 5, 7, 9, 11, 15	3, 5, 7, 9, 11, 15, 21, 23, 25, 27, 29, 31
Installation	S.4	S.5 (N219)	S.5 (N220, N221)	S.6 (N247, N248)	S.6B (S1595, S1596)



S.6B S1595 *with its R.A.F. handling crew at rest at Calshot in readiness for the 1931 Contest.*

Air Speed Record in S.6 *N247* at 357·7 m.p.h.

In 1931 economic depression caused the Government to decline to finance a Schneider entry but Lady Houston stepped into the breach and provided the necessary funds. The existing S.6 design was adapted and developed as stated and F/Lt. J. N. Boothman flew over the triangular course in the Solent on S.6B *S1595* at an average speed of 340 m.p.h. and so, in the absence of foreign challengers at the starting line, won the Schneider Trophy outright for Britain. Later F/Lt. G. H. Stainforth raised the World Speed Record to 407·5 m.p.h. on S.6B *S1595*, fitted with a special "sprint" "R" engine. This historic aeroplane may be seen in the Science Museum in London. Near it is its illustrious descendant, a Spitfire of vintage 1940!

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SPECIFICATIONS AND DATA

From official and company records. Any variations from figures sometimes published are due to differential loadings for test flight series.

Type	S.4	S.5	S.6	S.6B
Year	1925	1927	1929	1931
Serial and Racing Numbers	"4"	N219 "6" N220 "4" (winner) N221	N247 "2" (winner) N248 "8"	S1595 "1" (winner) S1596
Span	30 ft. 7½ in.	26 ft. 9 in.	30 ft. 0 in.	30 ft. 0 in.
Length (overall)	26 ft. 7¾ in.	24 ft. 3½ in.	26 ft. 10 in.	28 ft. 10 in.
Length (fuselage)	25 ft. 0 in.	22 ft. 0½ in.	25 ft. 3 in.	25 ft. 3 in.
Height	11 ft. 8½ in.	11 ft. 1 in.	12 ft. 3 in.	12 ft. 3 in.
Chord (M'plane)	6 ft. at root 4 ft. 3½ in. at tip	5 ft. 0 in.	5 ft. 8 in.	5 ft. 8 in.
Tailplane Span	8 ft. 2 in.	7 ft. 9 in.	8 ft. 1½ in.	8 ft. 1½ in.
Float Length	18 ft. 0 in.	18 ft. 6 in.	19 ft. 5 in.	24 ft. 0 in.
Float Track	7 ft. 6 in.	7 ft. 0 in.	7 ft. 6 in.	7 ft. 6 in.
Areas: Mainplane	139 sq. ft.	115 sq. ft.	145 sq. ft.	145 sq. ft.
Tailplane	15·8 sq. ft.	14 sq. ft.	15·8 sq. ft.	15 sq. ft.
Elevator	9·5 sq. ft.	5·8 sq. ft.	6 sq. ft.	6 sq. ft.
Fin	5·25 sq. ft.	4·50 sq. ft.	6 sq. ft.	6 sq. ft.
Rudder	6·625 sq. ft.	6·625 sq. ft.	7·5 sq. ft.	7·5 sq. ft.
Weight (empty) lb. ...	2,600	2,680 (N220)	4,471 (S.6A)	4,590
(loaded) lb. ...	3,191	3,242 (N220)	5,771 (S.6A)	6,086
Loading: (wing)	23 lb./sq. ft.	28 lb./sq. ft.	40 lb./sq. ft.	41 lb./sq. ft.
(power)	47 lb./h.p.	36 lb./h.p.	30·6 lb./h.p.	26 lb./h.p.
Aerofoil Section	Raf 30	Raf 30	Raf 27	Raf 27
Speed (maximum)	226·75 m.p.h. (world seaplane record)	319·57 m.p.h.	357·7 m.p.h. (world record)	407·5 m.p.h. (world record)
Speed "Landing"	85 m.p.h.	85 m.p.h.	95 m.p.h.	95 m.p.h.
Fuel (Imp. galls.)	40	50	106	135
Oil (Imp. galls.)	5	5	10	15
Water (Imp. galls.)... ...	10	15	20	25

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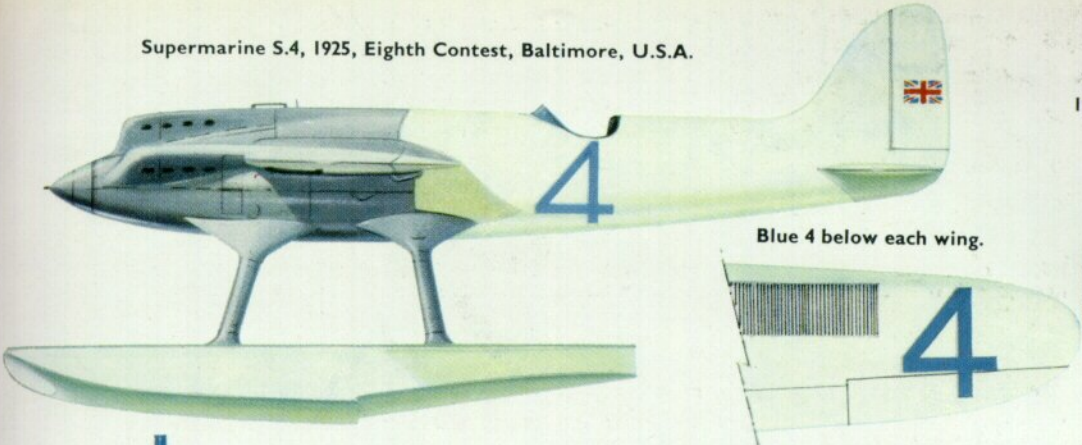
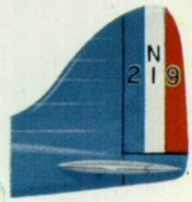
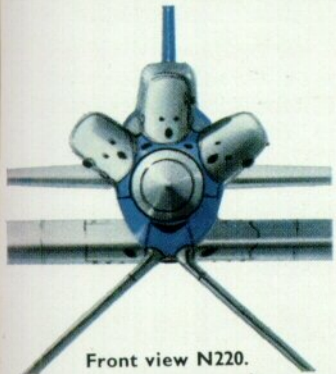
Supermarine S.4, 1925, Eighth Contest, Baltimore, U.S.A.



Trim tab added
1931 subsequently.



Blue 4 below each wing.



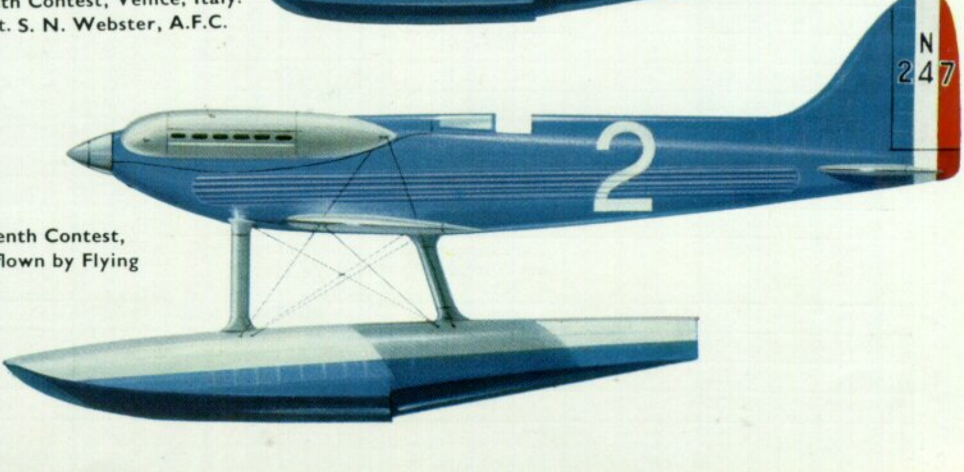
Front view N220.

Supermarine S.5, 1929, Eleventh Contest, Spithead, U.K.
Third, flown by Flt. Lt. D'Arcy A. Greig.

Black 5 below each wing,
N219, 1929 only.

N219, 1927.

Supermarine S.5, 1927, Tenth Contest, Venice, Italy.
The winner flown by Flt.Lt. S. N. Webster, A.F.C.



Supermarine S.6, 1929, Eleventh Contest,
Spithead, U.K. The winner flown by Flying
Officer H. R. D. Waghorn.

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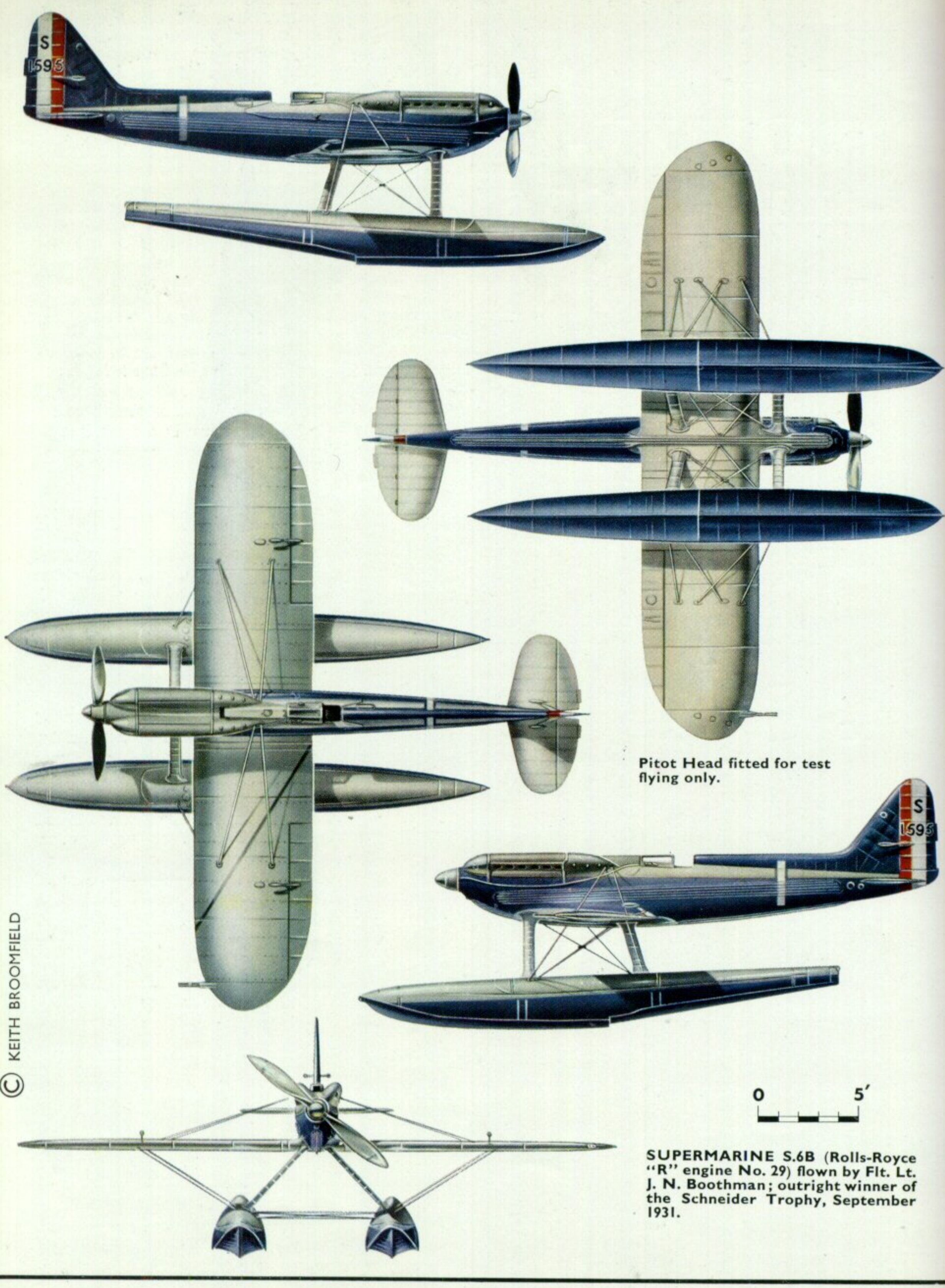

SUPERMARINE S.6B (Rolls-Royce "R" engine No. 29) flown by Flt. Lt. J. N. Boothman; outright winner of the Schneider Trophy, September 1931.

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