
# THE FLYING OF RACING SEAPLANES

Submitted by

NEWTON F. HARRISON

Supermarine S6b of 1931

In the not too distant future, perhaps even now, small boys may be saying "Daddy, what is a seaplane?" As of now, there are no racing seaplanes, nor have there been for many years. The Schneider Trophy Races instigated the development of many types of racing aircraft over the years, and had a profound effect upon one of the most famous airplane types in history, the Supermarine "Spitfire".

This article, submitted by Member Newton F. Harrison, conveys something of the old time spirit of hangar flying in its description of taking off and landing the Supermarine S.6A and S.6B seaplanes. This is extracted from The Aeronautical Research Committee Reports and Memoranda No. 1575 entitled "Collected Reports on British High Speed Aircraft for the 1931 Schneider Trophy Contest", published by H. M. Stationery Office in January, 1934. To quote Mr. Harrison, "information of this type is all too rare and gives an insight into the problems of the times that is omitted from the usual accounts of the Races."

The following was written by Wing Commander A. H. Orlebar, A.F.C., in 1931, as Section 8 of the Report.

The Schneider Race Team in 1929 (l. to r.) Flt/Lt H.R.D. Waghorn, A.F.C., (winner of 1929 contest), Fg/Off T.H. Moon(Technical Staff), Flt/Lt D'Arcy A. Greig, Sqn/Ldr A.H. Orlebar, A.F.C., Flt/Lt G.H. Stainforth, Fg/Off R.L.R. Atcherly.

FLYING AND WATER CHARACTERISTICS OF S.6A and S.6B SEAPLANES

It is considered that this record of data emerging from the final Schneider Trophy contest and speed record would be incomplete without a section devoted to the operational side, and whilst these notes are of necessity somewhat disconnected and incomplete - since at the time energies were directed rather to the successful performance in the contest than a careful compilation of operational data - yet they may serve a useful purpose by providing a reference to the handling of high speed seaplanes for the future.

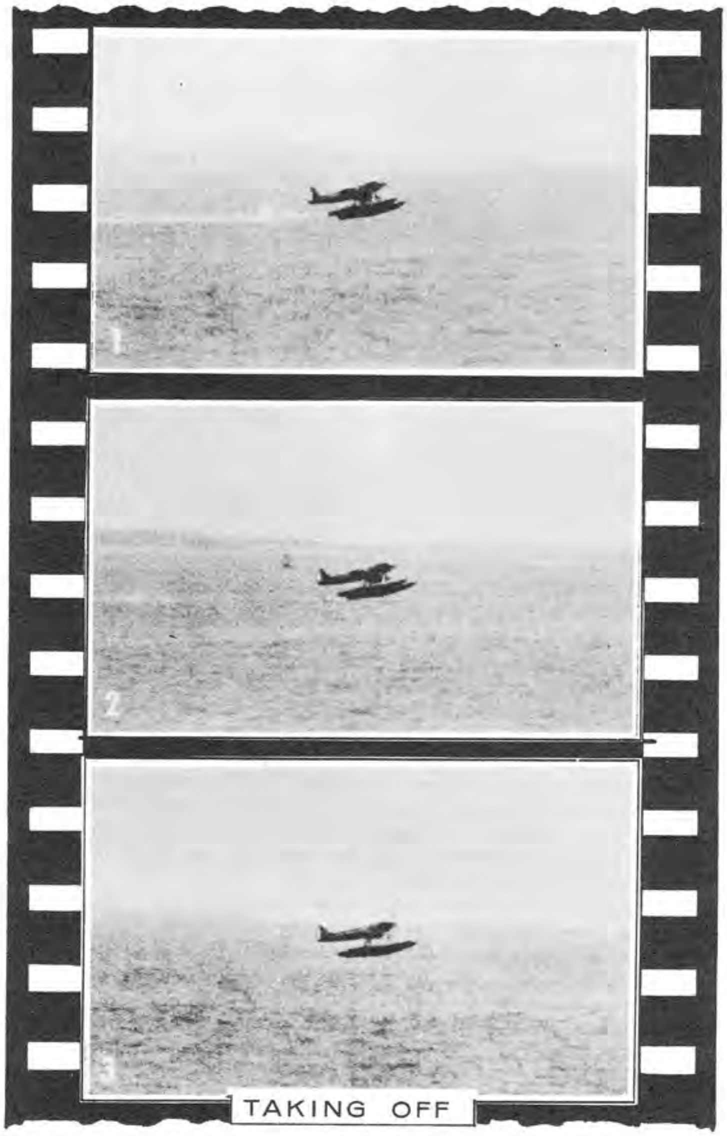
Aircraft:- All the high speed aircraft were easy to fly and comparatively easy to land, but experience is needed for the take-off particularly of the S.6 type. At the moment of take-off the S.6A and B were longitudinally unstable and needed careful handling to keep the nose up and maintain the angle of attack of the wings. This instability is aggravated if the C.G. is not kept well forward.

Engines:- The "R" engines gave very little trouble but need careful mixture adjustment on the ground. The building up of the fuel in the supercharger at low speeds caused some trouble in opening up, particularly with heavy types of fuel.

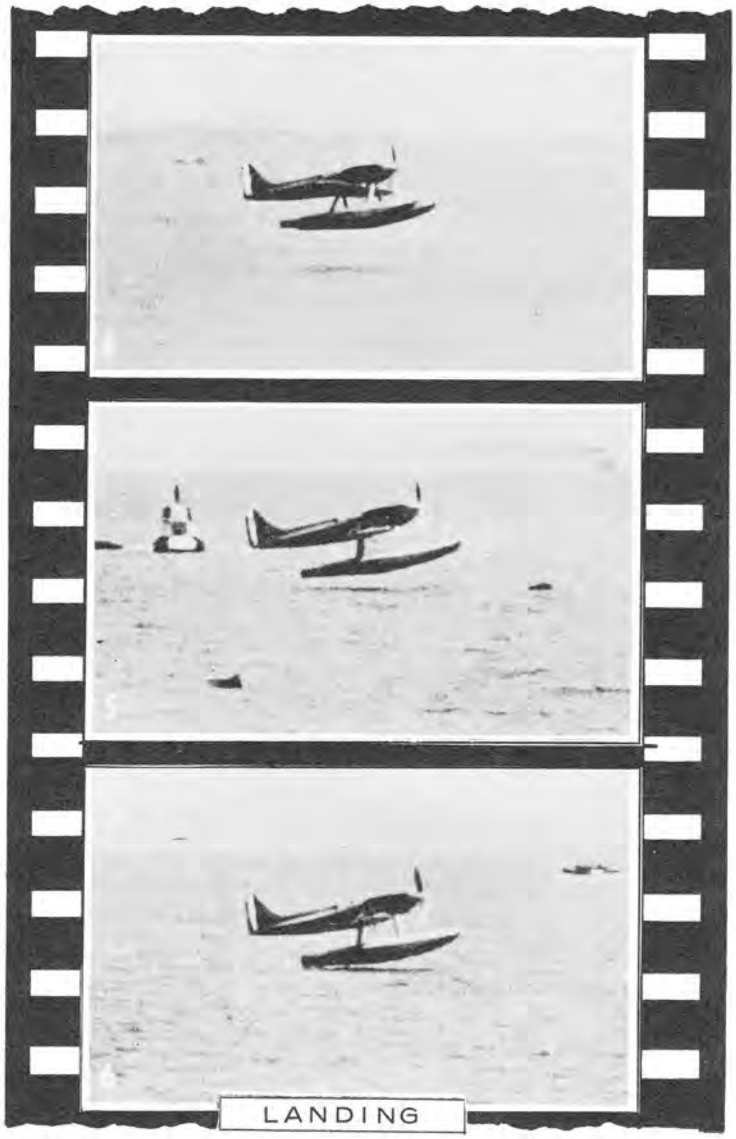
Airscrews:- Various airscrews of diameters ranging from 8 ft. 6 in. to 9 ft. 6 in. were tried, and it was found that the larger diameters showed little if any loss of top speed and had much better water performance. Very high pitched airscrews gave bad swinging and dip-

Augustus Henry Orlebar transferred to the R.F.C. in September, 1916 after serving at Gallipoli with the Bedfordshire Regiment in the early part of the war. He was credited with 12 enemy aircraft while in No. 73 Squadron ("Camels") and was himself shot down in March, 1918. After the war he received a permanent commission in the R.A.F. and became a test pilot at Martlesham Heath. He became a Squadron Leader and Officer Commanding the High Speed Flight at Felixstowe.

In September, 1929 S/L Orlebar gained the World Air Speed Record at 357.7 m.p.h. in the Schneider Trophy Race, and in 1931 he again led the Schneider Race Team. Also in 1931 he became a Wing Commander and rose steadily in rank until his death in 1943 when he was Acting Air Vice Marshall and Deputy Chief of Combined Operations.



TAKING OFF



LANDING

ping of the port float on the water.

Blades wide at the root and tapered sharply to the tip in plan form caused more trouble than wider tip blades. Table I gives a summary of individual airscrews on water performance.

Taxiing:- With the engine throttle "right back" the aircraft will turn cleanly in any direction in a light wind, but the yaw is slow and difficult to stop without a burst of engine. There is a danger of fuel building up in the supercharger at this speed if it is maintained for at all a long period (i.e., say two minutes.) The aircraft swings left if the engine is opened up and further is very blind on account of spray. With narrow tipped airscrews the left wing also dips badly, particularly on the S.6A.

Take-off:- (a) First open up:- A drill was adopted for this period. The aircraft is put well to the right of wind and held there without yaw while the pilot ensures he has a clear run into wind. He then applies full right rudder and full elevator control, bends his head well forward and down under the windscreen to shield his goggles, and then opens the throttle full out fairly rapidly. In this way he can go through the first second or two while the aircraft is swinging left and the cockpit is covered with spray, and he can get a clear view with clean goggles afterwards to apply rudder control as soon as it becomes available.

(b) Getting to and running on step:- It is necessary to maintain full back elevator control through this period, since in coming on to the step the aircraft tends to porpoise owing to the tail coming up too far as the attitude changes to the flatter running angle. If acceleration continues the porpoising quickly stops, but if the porpoising is sufficiently violent to prevent acceleration it will continue, and may become sufficiently bad to make the machine jump clear of the water. In this case it is advisable to throttle down and start again.

Once the aircraft is accelerated through this period, i.e., to roughly 40 m.p.h., it runs very smoothly and easily, but the control column must be kept hard back, since otherwise porpoising may recommence. In disturbed water at speeds over 80 m.p.h., it is sometimes possible to allow the control column very slightly forward to prevent the aircraft jumping into the air at too steep an angle. Throughout, the view ahead is very bad, but when once on the step it is possible to swing slightly in either direction.

(c) Becoming air-borne:- The aircraft leaves the water at a fairly steep angle rather suddenly. A cinema record of this stage is shown in Fig. 1. In the first few seconds afterwards the acceleration is quite slow and it is essential to maintain the angle of attack of the wings, since otherwise the aircraft will sink and touch again. During this period the elevators are quite effective but must be kept well up and handled very gently, as there is a certain amount of longitudinal instability.

In Flight:- (a) Controls:- All controls are very effective at all speeds, except the lateral control which disappears rather suddenly at the stalling point. They are light to operate with the exception of the ailerons, and these are not uncomfortable.

(b) Stability:- Longitudinal instability is very noticeable if the aircraft is at all out of trim, this is increased by any backward movement of the C.G. This is particularly marked at the moment of take-off, in bumpy weather and at high speed. In tight turns producing accelerations around 4g it was necessary to hold the control column forward against a marked inclination to flick back in backward positions of the C.G. When the control was properly adjusted no instability in the yawing plane was noted.

Lateral changes of trim occurred, due to uneven distribution of fuel, causing rather uncomfortable loads for landing and correction was very tiring at high speed. When properly rigged the aircraft fly level hands and feet off at a speed just below full out. They are slightly nose heavy at full speed and slightly tail heavy landing.

Turning:- It was found that turns should be kept as level as possible, using as little control as possible, to keep the nose from rising in the early stages of the turn. Fairly gentle but firm application of the control is preferable to any jerking. Much practice was found necessary to ensure keeping the turning marker at the peak of the turn and close to the circumference of it.

Landing:- (a) Approach:- Owing to blindness ahead it is necessary to approach across wind, then choose a line into wind clear of obstruction and keep to it. The aircraft touches at about 110 m.p.h., and the approach speed should be some 50 m.p.h. above this. Even then the nose is higher on the horizontal than at full speed level and the aircraft sinks quite rapidly.

(b) Touching:- On the flattening out at the above speed, the aircraft "floats" for at least a mile, which gives time to get the height above the water right. The aircraft should be held in the air as long as possible and the control column brought back till the angle of attack is about that at the moment of taking off. A cinema picture of a landing stage is shown in Fig. 2.

It is possible, by flattening out rather high and pulling the control column back hard as the aircraft sinks, to get into a steeper angle whilst in the air. The heels of the float then dig in and the aircraft pitches forward on to the keels of the floats and may jump off again.

Once on the water the control column should be held hard back. Swinging due to one float or the other digging into the water too much can be checked easily by coarse and quick qpplication of the rudder.

Weather Conditions:- It was impossible to operate in any form of swell such as occurs after rough weather or from the wash of ships, as it will throw the aircraft, either taking off or landing, high into the air without flying speed.

Choppy water will not cause much trouble so long as the distance between crests is really short. In the Solent conditions are usually unfit if the average wind exceeds 15 m.p.h., also irrespective of the wind speed the appearance of white crests may be taken as a general indication of unsuitability.

ABOUT THE AUTHOR - Member Newton F. Harrison is at present an R.A.F. Squadron Leader (D.S.O., A.F.C. & Bar) on a ground tour at the Air Ministry, having recently left Farnborough where he was on the staff of the Empire Test Pilot's School. He began flying in 1939 with the South African Air Force and transferred to the R.A.F. in 1951. Most of his flying was on fighters (P-36, P-40 and "Spitfire"), plus nearly ten years in test flying at Farnborough.

Good visibility of a range of at least three-quarters of a mile is essential in order to judge height, cover room to maneuver and to see obstacles in time. An area of water of at least two miles long into wind and three-quarters of a mile wide is essential for taking off and landing even with light loads on the S6 type and an efficient airscrew. For tests with airscrews inefficient on the water even greater areas may be needed.

TABLE I

Effect of Individual Airscrews on Water Performance

| Aircraft No. | Airscrew Diam. | Pitch (ft.) | P/D | r.p.m. Static | Max on water |
|---|---|---|---|---|---|
| N.247 (S.6A) | 8.5 | 20.415 | 2.41 | 2,500 | 2,350 (7/8 throttle) |

Pronounced left swing greatest at low speed and high r.p.m. Left float dips very badly and dip increases with increase of r.p.m. up to max. water speed attained, i.e., 30-40 m.p.h., and then swung out of wind.

| Aircraft No. | Airscrew Diam. | Pitch (ft.) | P/D | r.p.m. Static | Max on water |
|---|---|---|---|---|---|
| N.247 (S.6A) | 8.5 | 17.93 | 2.11 | 2,450 | 2,200 (7/8 throttle) |

As above, dipping not quite so bad, but swinging tendency to left slightly worse. Possible to ease to right by throttling and decelerating when over hump speed, but tendency to swing left again appears when opening throttle to accelerate. This test was started 90 deg. to right of wind yawing right, and stopped 45 deg. to left of wind.

| Aircraft No. | Airscrew Diam. | Pitch (ft.) | P/D | r.p.m. Static | Max on water |
|---|---|---|---|---|---|
| *S.1595 (S.6B) | 8.5 | 17.93 | 2.11 | 2,700 | 2,500 |

Swinging not so bad and dipping disappeared. Just possible to maintain straight course at about 40 m.p.h. with full engine after gradually opening throttle with a resulting swing of about 150 deg.

| Aircraft No. | Airscrew Diam. | Pitch (ft.) | P/D | r.p.m. Static | Max on water |
|---|---|---|---|---|---|
| *N.248 (S.6A) | 9.5 | 18.22 | 1.918 | 2,300 | 2,200 |

Very little swing and no dipping even with quick opening to full throttle.

| Aircraft No. | Airscrew Diam. | Pitch (ft.) | P/D | r.p.m. Static | Max on water |
|---|---|---|---|---|---|
| N.247 | 9.5 | 18.275 | 1.923 | 2,150 | 2,000 |

Very little swing and no dipping even with quick opening to full throttle. Accelerates past hump speed fairly easily. Tendency to bury right float upon slowing down.

| Aircraft No. | Airscrew Diam. | Pitch (ft.) | P/D | r.p.m. Static | Max on water |
|---|---|---|---|---|---|
| N.247 (S.6A) | 9.5 | 18.75 | 1.97 | 2,350 | 2,300 |

No swinging and very slight dipping. Acceleration very good and aircraft clean during most of take-off.

| Aircraft No. | Airscrew Diam. | Pitch (ft.) | P/D | r.p.m. Static | Max on water |
|---|---|---|---|---|---|
| N.247 (S.6A) | 9.5 | 17.85 | 1.88 | 2,175 | 2,100 (at 80 mph) |

Original 1929 floats: Swung about 45 deg. left, straightening up at about 1,800 r.p.m. and 25 m.p.h. Dipping very bad during early stages, but overcome at about 20 m.p.h. Fuel load 20 galls, port, 46 starboard. Other trials with fuel load ranging from 20 galls starboard and nil galls port, appear to have little effect on dipping but uneven load helps swinging appreciably.

| Aircraft No. | Airscrew Diam. | Pitch (ft.) | P/D | r.p.m. Static | Max on water |
|---|---|---|---|---|---|
| *S.1595 (S.6B) | 9.125 | 17.83 | 1.966 | 2,600 | |

Tendency to swing left out of wind, after hump speed was passed by applying right rudder.

* 1931 engines.

(Continued on Page 139)

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TO BE CONTINUED IN THE FALL ISSUE

## Dateline Dayton - 1924

(Continued from Page 108)
first produced in 1923, and offered considerably improved performance over the first Laird "Swallow". It was produced through 1928, when the company was placed in the hands of receivers and passed from the control of Jacob Mollendieck, its president, to a group of Wichita businessmen. Known as the "Super-Swallow", it received ATC #21 when Federal licensing and certification came into being in 1926. Two "Super-Swallows" were flown to the 1924 Dayton Races, one by Billy Parker, later of Phillips Oil fame.
Note: These photographs were made available through the courtesy of Mr. John C. Columbus, pioneer Kentucky pilot and owner of a Jenny and a Thomas Morse S4C during the early twenties. The author gratefully acknowledges loan of the original negatives for the purpose of making this layout.

## FLYING RACING SEAPLANES

(Continued from Page 99)

*S.1595 9.125 18.98 2.04 2,450 -
(S.6B)
About the same as above (slightly worse.)

*S.1595 9.125 18.72 2.025 2,550 -
(S.6B)
Better than the above. Quite good considering fuel load, i.e., 90 galls starboard, 45 galls port.

*S.1595 9.5 18.27 1.925 2,350 -
(S.6B)
Slight tendency to swing. Possible to maintain straight course from start to take-off.

*S.1596 9.5 18.77 1.977 2,325 -
(S.6B)
With full right rudder swung at low speed first right and then left. By keeping right rudder on swing into wind at about hump speed.

*S.1596 8.833 18.33 2.075 2,600 -
(S.6B)
Weather cocks at slow tick over, and swings left at high revs. Opening up just to right of wind, swung more than 90 deg. as speed increased to hump speed. Second attempt opening up further to right of wind same occurred.
Final attempt started 90 deg. right of wind, swung 110 deg. then checked, course maintained and take-off made with full right rudder and right aileron.

S.1595 9.5 18.27 1.922 2,375 -
(S.6B)
Slight swing to left, but straight course can be maintained by right rudder.

*1931 engines.

Except where otherwise mentioned, the trials were made with 1931 type floats and 90 galls. fuel (60 galls. starboard and 30 galls. port.)

One other extract that is of interest is from Section 1 of the same book, the author of the Section being H. M. Garner, M.A.: -

One series of tests dealt with the cooling problems. The method of cooling the water-cooled engines on high speed aircraft by means of surface radiators was first introduced into the Schneider Trophy Contests in 1925. Although a surface radiator system is much heavier than the older systems, the effect of reduction in resistance on the level speed of the aircraft is much greater than that of the increase in weight. The use of surface radiators has led to such a cleaning up of high speed aircraft that it is difficult to see how any large further reduction in resistance can be obtained. On the S.6. most of the exposed surface of the seaplane was used for cooling either the water or the oil, and one problem on the S.6B was to find means for the additional cooling necessitated by the increase in engine power since 1929. The additional cooling was mainly obtained by fitting more coolers on the tops and sides of the floats. A small amount of further cooling was ultimately required and this was obtained by fitting louvres into the wings near the tips* to direct air over the inner surfaces of the radiators. The problem was to obtain a large flow with as little increase in resistance as possible. The best results were obtained with the entrance chamber streamlined.

"The stage appears almost to have been reached on high speed aircraft with water-cooled engines in which a lower limit to the wing area is set by the amount of cooling required for the engine. It may prove more economical to increase wing area in order to obtain additional surface cooling, rather than to use auxiliary cooling devices."

*The louvres which are mentioned above were fitted so that the entering air did so from under the wingtip, a region of high pressure, while the outlet louvres were placed on the upper surface of the wing near the wing root, a region of low pressure. In this way the pressure difference about the wing was used to induce the cooling airflow.

All this is interesting in view of the types of radiator developed during W.W.2 years when, on aircraft such as the Spitfire and Mustang the radiator actually produced no drag or perhaps even a slight thrust due to having an accelerating effect on the heated air. END.