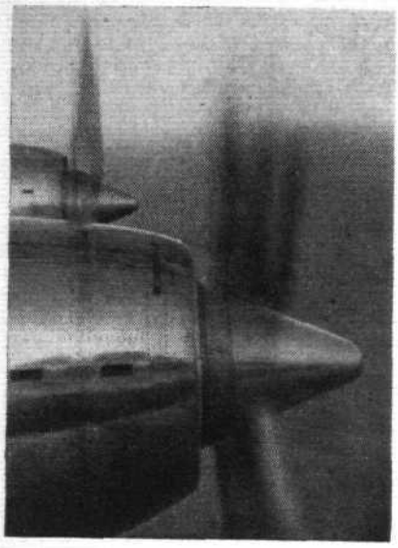

PROVING the BRITANNIA

By CAPTAIN A. S. M. RENDALL, B.Sc

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Captain Rendall, who since 1953 has been closely concerned with the operational development of the Bristol Britannia, recounts his personal impressions.

During the tropical trials in Johannesburg somebody said, "If I understand you correctly, the Britannia is a very orthodox aeroplane except that the controls are not attached to the control surfaces and the propellers are not attached to the engines."

BRITISH Overseas Airways Corporation has been associated technically with the Bristol Britannia from the outset, when the project was conceived as an aircraft with four Centaurus piston engines and an all-up weight of 114,000 lb; but it was only just over two years ago that a nucleus of operational personnel was formed to participate in the development. Starting in October 1953 with two pilots and the fleet manager designate, this nucleus grew until by the summer of 1955 it comprised 17 pilots, five engineer officers, four radio officers and two navigation officers. Throughout this period there has been very close co-operation and exchange of views between B.O.A.C. and Bristol.

For the first year there was no solo flying for B.O.A.C. pilots, but there was much to be learnt and many operational aspects to be discussed. Towards the end of 1954 a programme was arranged for Britannia aircraft to accumulate 2,000 flying hours before C. of A. application; of this, 1,000 hours was to be done on G-ALBO (the prototype) and the remainder on G-ANBA and G-ANBB. This flying programme could not have been carried out in the time planned by Bristol test pilots alone. Early in 1955, therefore, B.O.A.C. were asked to take over the flying on G-ALBO completely; thus, during the first half of last year, B.O.A.C. crews, most of whom will be flying instructors for the Britannia Fleet, flew some 600 aircraft hours on this machine.

Later came a further programme for 250 hours of route-proving flying. For these flights, not only was the aircraft to be operated through the climates and conditions it will meet in service, but also the laid-down maintenance schedules were to be followed and representative turn-round times adhered to. An ambitious programme of eight flights, to East Africa, Johannesburg, Bombay, Lod, Tripoli and Rome, was planned; and, in the event, the flights were completed in 41 days, at an average aircraft utilization of just under six hours a day. Again B.O.A.C. crews were asked to do this flying and, by putting double crews on each flight, the best use was made of the flying from a training point of view, and this also helped to keep the aircraft on the move. The "passengers," who usually numbered some 45, were technical observers and maintenance staff, except on the flights to Tripoli and Rome, when it was required to fill the aircraft to capacity. Then the 98 souls on board included a number of employees of Bristol and B.O.A.C. who had no more-onerous duties than to fill in a "comments card." A full B.O.A.C. cabin staff took good care of all on board; and many hardened observers, accustomed to cabins furnished with recording cameras and water ballast tanks, received the full luxury airline treatment for the first time. Incidentally, one could not but admire the composed manner in which the stewards unblushingly briefed the designers and manufacturers on the amenities and emergency equipment of their own aircraft. No less did one admire the stewardess who could make a technical observer sit down and fasten his seat belt for take-off.

B.O.A.C. personnel also participated in the overseas trials in G-ALBO at Tripoli in October 1954 and in G-ANBA at Johannesburg and Khartoum in March 1955, as well as on numerous other flights around Filton during the last two years. The eight Britannias that have flown so far had, by the end of February, 1956, accumulated a total of 3,300 hours in the air, of which 1,400 have been flown by B.O.A.C. crews.

What, then, do B.O.A.C. pilots think of the aircraft?

The control system referred to in my opening paragraph is unusual. All the control surfaces are operated entirely by servo tabs and the weight and complexity of systems which depend on brute force are avoided. The pilot's controls would be over-light if no artificial feel were fed into them; in the case of the rudder and ailerons this is done by means of spring pots, but in the elevator system the "Q" pot makes the weight of the control dependent on airspeed in a realistic manner. The rate of response to aileron deflection was considered at one time to be inadequate, and was in consequence improved, but one of the interesting facts that came out of the comparative tests conducted on another aircraft of similar size was the docility of the rolling tendency of the Britannia when an outboard engine was failed and no corrective action was taken. The effectiveness of the controls in severe turbulence was clearly demonstrated when, on a flight in search of ice, the aircraft was flown for a couple of hours through a series of thunderstorms around Lake Victoria, search radar being used to guide the Britannia into the centre of each storm. Attempts have been made to stall the aircraft during take-off by holding the "pole" fully back throughout the run; even with deliberate engine failure, no handling difficulties were encountered and the only effect was to decrease the distance-to-50ft by 20 to 30 per cent. Some fear was felt that ice-accretion on the elevator horn balances might seriously affect control, but it was recently demonstrated that $5\frac{3}{4}$in of ice made not a ha'p'orth of difference at speeds from 180 kt down to the stall [see photograph overleaf—Ed.].

The behaviour of the aircraft on instrument approaches is very good, provided the rudder pedals are regarded merely as foot rests and the ailerons alone are used for following the localizer; any tendency to "harmonium feet" must be strongly suppressed. The elevators were at one time rather too light when flaring out for the landing and there was a tendency to "balloon"; this has been rectified most effectively by the fitting of a bias spring on the main elevator surfaces.

The pre-stall buffet is sometimes very close to the stall, so a stall-warning device in the form of a stick-shaker is fitted; this gives a very obvious warning at a minimum of 5 kt above the stall. As the main aileron surfaces are in no way connected together, both ailerons would tend to float upwards as the stall is approached, so a spring arrangement similar to that on the elevators is incorporated; this ensures lateral control down to the stall in all power-off configurations.

There can be few aircraft which, if stalled with a lot of power on, behave with complete gentility, and with persistence and a certain rugged determination the Britannia can be made to drop a wing fairly smartly under these conditions. With power off, the behaviour is very docile; a little buffeting, a controllable wing-drop, a gentle pitching and you're all set to do it again.

So much for the controls. My other opening reference was to the well known free-turbine arrangement of the Bristol Proteus engine, designed to give economy, flexibility of operation, ease of starting, and so on.

The Proteus has a long history of development behind it and is giving every indication of coming up to the high standard of reli-

The author of this article.