JOINT authors of a main Royal Aeronautical Society lecture, delivered on February 14 and dealing with the development of the Fairey Delta 2 supersonic research aircraft, were Mr. R. L. Lickley, B.Sc., F.R.Ae.S., technical director and chief engineer of the Fairey Aviation Co., Ltd., and L. P. Twiss, test pilot of the company. It was Mr. Twiss who secured the world's speed record of 1,132 m.p.h. with the F.D.2 on March 10, 1956.

In the first part of the lecture Mr. Lickley dealt with design and construction, and in the second part (to be dealt with next week) Mr. Twiss described some features of flight testing, leading up to his record flight and later flying.

Mr. Lickley introduced his contribution by recalling that the development of manned supersonic aircraft in this country suffered a setback at the end of the 1939-45 war, when it was decided that the use of manned machines would be too dangerous. More realistic views soon prevailed, however, and as a result the ordering of such aircraft was considered in 1947 by the Ministry of Supply. In Fairey's submission to the M.o.S. in 1949 the aircraft was described as having as its primary function research flying at transonic and supersonic speeds up to \( M = 1.5 \).

The background which led up to this submission [Mr. Lickley continued] is of interest, as it shows a logical line of development within the company. In 1947 the company was developing the F.D.1 at Stockport and scale models of it at Heston, in order to conduct vertical take-off experiments. The models were of advanced design, powered by a rocket motor with twin combustion chambers, controlled in pitch and yaw respectively by an automatic pilot. Information of behaviour in flight was tele-metered to the ground. In September 1947 the company was asked if it could further develop the vertical take-off models to fly transonically after ground launching. After consideration it became clear that, although the technique and experience of the V.T.O. models would be of great value, the experiments themselves would be of little use unless they were aimed at obtaining specific information on a layout representative of a typical possible piloted supersonic aeroplane. We, therefore, began a design study of such a piloted aircraft as a preliminary to the design of the pilotless models. Our first efforts resulted in a design of high sweepback on both leading and trailing edges, all-moving tip ailerons, conventional tailplane and twin engines in the fuselage fed from a nose intake (English Electric P.1-type layout). This design was not proceeded with, but in February 1949 we were approached by P.D.S.R. (A) [then Sir Harry Garner], and asked to consider an alternative design for a further supersonic research aircraft, preferably based on a single engine. We had, of course, by this time considerable background in the problems of designing such an aeroplane. We had developed the necessary new techniques of drag and performance estimation and had collected together what slender information there was on the stability and control characteristics of various configurations. We decided to begin our considerations afresh and, by the end of the year (December 1949), had come to a firm proposal [see 3-view drawing on page 236.—Ed.] which differed very little from the aeroplane as it is flying at present, although pressure from various sources to make changes was at times very strong.

The design which evolved was a delta-wing plan form of aspect ratio 2, having a Rolls-Royce R.A.5 engine in the body, with wing root intakes having frontal areas cut to a minimum and all possible excrescences removed. The major target and guiding principle in the whole design period was to get an aeroplane of minimum weight, with the smallest frontal and surface areas, while still remaining a straightforward aeroplane to handle in the air and on the ground, and yet at the same time large enough to house the R.A.5 engine and sufficient fuel to enable worthwhile flights to be made. As an indication of the design problems raised by this approach, the maximum clearance between engine and fuselage skin is less than 6in and, within this space, room had to be found for the main frames to which the wing is bolted. Although the aerodynamic form was decided at an early period, the contract to build two aircraft was not placed until October 1950: lack of money, priorities and other problems, caused this hold-up and almost immediately after the placing of the contract "super-priority" intervened, and the need at Fairey's to concentrate on the Gannet meant that a fully effective start was not made on the design work until the summer of 1952. manufacture effectively began about the end of that year. Little or no priority was given to the aircraft and, because of the demand on wind tunnel capacity for tests of Service types under development, only very meagre and belated high-speed tunnel tests had been undertaken before the aircraft flew. In fact, some supersonic tests were only analysed after the aircraft had flown supersonically.

Aerodynamic Design. A moderate wing-loading was chosen to give good high altitude performance, medium landing speeds and good performance from normal length runways. At 4 per cent, the t/c ratio is still one of the lowest flying, and at the design date (1949) was the lowest known. The advantages of the tailless layout were held to outweigh the reputed disadvantages and, when one considers the various tail layouts to be seen today, and the established need for fully-variable tailplanes, the choice seems to have been the correct one, possibly more than anything else because of the aerodynamic simplification produced.

Side intakes were decided on, as it was felt that the structural simplicity and saving in weight, compared with a nose intake, were worth more to the design than the possible aerodynamic difficulties introduced. At various times, the intakes were the subject of strong criticism, both from the aerodynamic aspects and from the possible bad effects on compressor flow, but they have remained substantially as initially conceived, and have proved satisfactory up to the highest Mach numbers reached.

Much discussion has ranged round trim drag and the penalties it applies to delta aircraft. Our thinking led us to believe that much of the drag could be avoided by careful design and, in particular, by the use of large-chord controls which would keep the angular movements reasonable. So far, our only problem