D.H. 108

FASTER THAN SOUND

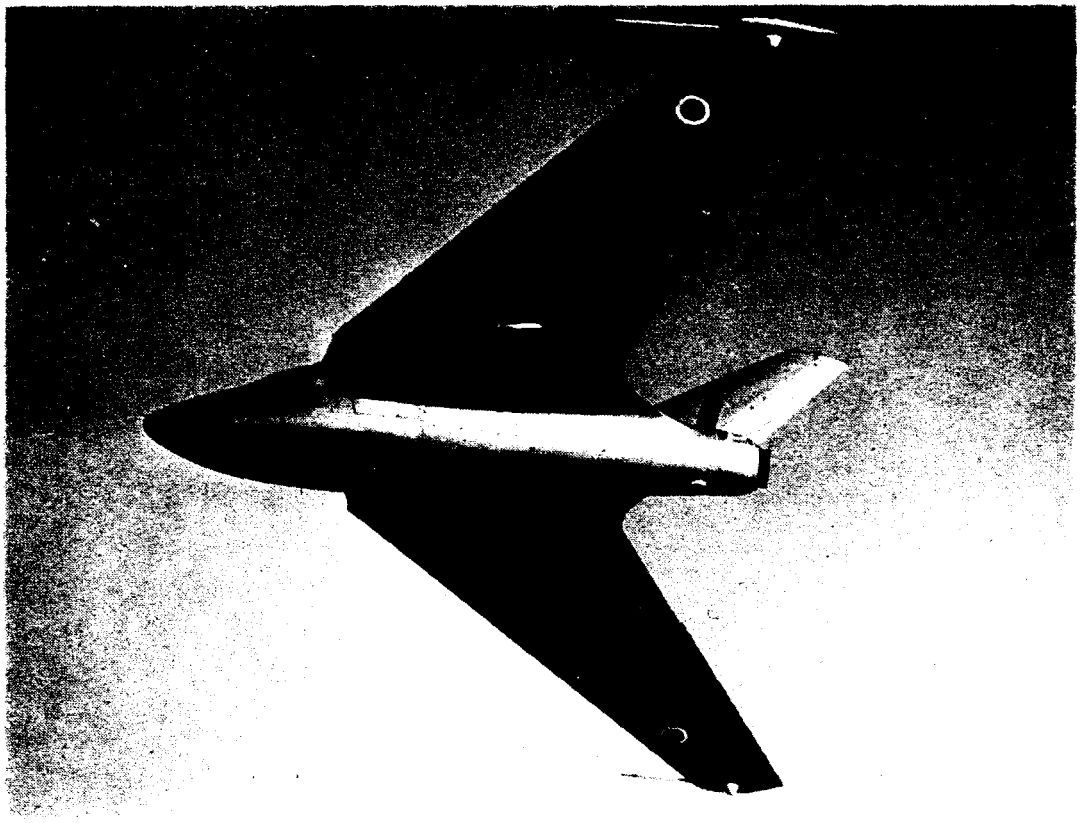
In the " Journal of Naval Engineering," Vol. I, No. 2, an article on " Supersonic Flight " discussed some of the problems involved in designing aircraft to fly at supersonic speeds. On September 6th, 1948, for the first time in Britain human flight at a speed greater than sound was achieved, and an acknowledgment of this important event is recorded here.

The aircraft used was the D.H.108 which had been designed and built for the purpose of exploring control and stability problems in aircraft with swept-back wings. This aircraft is not in any sense of the word a " flying wing," but has a fuselage which is in fact that of a standard Vampire ; it is engined by a D.H. Goblin jet turbine. It has no tail plane or elevator and the ailerons perform the function. It has, however, a fin and rudder of high aspect ratio, and a considerable sweep-back. The idea of a pronounced sweep-back is of course that of dealing with the onset of compressibility effects.

This aircraft is for research purposes only, and it has been developed so that data may be obtained for later application to both military and civil aircraft.

At 10 o'clock in the morning of September 6th, Mr. John Derry in the D.H.108 took off from Hatfield on a flight which lasted 40 minutes. The flight was part of a research programme in which the aircraft has been flown at increasingly high Mach Numbers ; in the previous week successive flights had been made at Mach Numbers from 0.91 to 0.95. On this occasion, while flying between Farnborough and Windsor, the aircraft was put into a dive at about 40,000 ft. Before the pilot levelled off at around 25,000 ft. he had surpassed a Mach Number of 1. (Perhaps it is worth while refreshing our memories that the Mach Number, after Dr. Ernst Mach, a Viennese physicist and philosopher, is the ratio of the true air speed of the aircraft to the speed of sound.) The measurement beyond unity is not known precisely as the instrument was calibrated only to that point, but the needle was able to move around the unmarked dial, and it is clear that a true air speed approaching 700 m.p.h. was attained.

A dive recovery brake was used to assist the pilot in pulling out of the dive. Considerable physical strength was needed to complete the recovery, but the aircraft handled well and the pilot reported no unusual physical sensation. He suffered no black-out and was able to note the maximum reading of the Mach meter.



It is necessary to make these high speed tests in diving attitudes because the little de Havilland Goblin jet turbine is not sufficiently powerful to achieve such speeds in level flight.

The flow of air over an aircraft flying at speeds regarded until recently as " normal "—(up to a Mach number of about 0.7)—follows rules not dissimilar to those obeyed by water around the hull of a ship. At the speed of sound (M = 1.0) and above, the pressure waves produced by the passage of the aircraft cannot travel ahead to prepare the air for deflection around the approaching body since their speed is no greater than that of the body itself. In consequence, the aircraft meets the air without any warning, deflecting it with a sudden shock effect. At these speeds, therefore, the flow over the aircraft follows laws different from those governing the effectively incompressible flow which is found at lower speeds and Mach Numbers. It is in the transonic region, *i.e.*, M = 0.9 to 1.1, that these phenomena present the greatest problems to the designer.

Air, to pass round an aircraft, must accelerate over parts of the surface to speeds above that of the aircraft itself. It therefore follows that at true aircraft speeds below that of sound local flow may reach or exceed a Mach Number of 1.0. It is these areas of supersonic flow which produce localized pressure changes having effects on the behaviour of the aircraft which are often unpredictable, because one set of laws is breaking down and another set is establishing itself, producing inconsistencies of behaviour about which little is yet known.

Technical effort to-day is directed towards the evolution of aeroplanes having satisfactory characteristics at low speed and yet able to reach higher and higher Mach Numbers without encountering unacceptable control difficulties or structural stresses resulting from these local disturbances. In the

supersonic region the airflow tends to stabilize once more in a new pattern, which enables the designer to predict the behaviour of an aircraft with a degree of certainty which he is at present denied in the transonic zone.

The extension of knowledge of transonic flight is to a great extent empirical, but the practical experience gained from steady and cautious advancement in flight-testing is to-day rapidly broadening and refining theoretical knowledge of a subject of unequalled importance to the future of aviation.