# Critical Mach number

At any constant aircraft forward speed, the speed of the airflow will vary over the curves and cambers on the different areas of the airframe. The behavior of the airflow over the wing will be particularly significant, since this is the major lift provider for the aircraft.

As air flows over the camber on the upper surface of the wing, its speed will increase as it flows rearwards from the leading edge, reaching a maximum at the thickest part of the wing chord. This means that although the aircraft itself may be travelling at an airspeed well below Mach 1, the airflow over the thickest part of the wing chord, may have already reached Mach 1

Therefore, the designers may either incorporate features that will lessen the unwanted effects, or limit the aircraft to a predetermined maximum airspeed, that will ensure the wing speed remains below Mach 1 and thus avoids the unwanted effects altogether.

For each aircraft type therefore, a unique maximum aircraft forward speed will be calculated, corresponding to a wing speed of Mach 1. This aircraft speed (always be less than Mach 1) is called the Critical Mach Number or M. crit and non- supersonic aircraft flying in the transonic flight range, will normally be limited to a maximum speed set below the Critical Mach number.

A thick wing will cause the airflow to speed up over the camber and reach Mach 1 more quickly than a thin wing of similar chord length. Consequently, the Critical Mach number for the thinner wing will be a higher value than the thicker wing.

This in turn will mean that the aircraft with a thin wing will be able to fly faster in the transonic flight range than the one with the thicker wing, before the unwanted effects caused by the wing reaching Mach 1 ensue.

Conversely, less lift will be produced by a thin wing, than a thick wing of similar chord length, but this can be overcome by the so-called Supercritical wing chord.

In this design, the total amount of lift lost by the shallower camber of the thin wing is restored by making the chord longer. This is perfect for transonic cruise conditions, but at low airspeeds, lift on a clean wing will be insufficient and so extensive use of high lift devices (slots, slats and flaps) is necessary