Terminal velocity

Why is the word velocity used here? Speed is what we measure on a car speedometer. It just records the amount of ground covered and does not concern itself with the direction of travel, which will be constantly changing. Velocity is a technical term. It includes both the speed and the direction of travel. A force is needed to change each. So an object travelling at constant speed will still need a force to change its direction. For example a satellite travelling at a constant orbital speed needs a downward force to change its direction and make it travel in a circle. That force is weight. A car cornering at constant speed needs a sideways force from tyre friction to make it change direction in the curve. A banking aircraft has a component of its lift pushing it in the direction of its turn. However a vertically falling object doesn't change direction so perhaps the words should be 'terminal speed'.

Drag increases with the square of the speed. Going from 10 to 20 m/s means the drag is four times higher. This is why a car or aircraft has a maximum speed. It accelerates until the drag has risen to equal the forward thrust of the engine. Similarly a sky-diver in free fall accelerates until the drag on his body equals his weight at about 60 ms^{-1}. This is terminal speed.

High speed flight

All of the above only applies to sub-sonic flight. Air particles move on average at the speed of sound, which is why sound travels at the speed it does. When an aircraft goes faster than the speed of sound the air particles that bounce off it cannot escape forwards so build up and form a region of high pressure. Shedding this causes the V-shaped pressure waves that create a 'sonic boom' when they hit the ground. These pressures increase the drag dramatically and their turbulence can cause flutter which was a major cause of the instability called the 'sound barrier' in the early days of fast flight. The picture shows a beautiful NASA image of the pressure 'shock' waves around a real aircraft in flight.