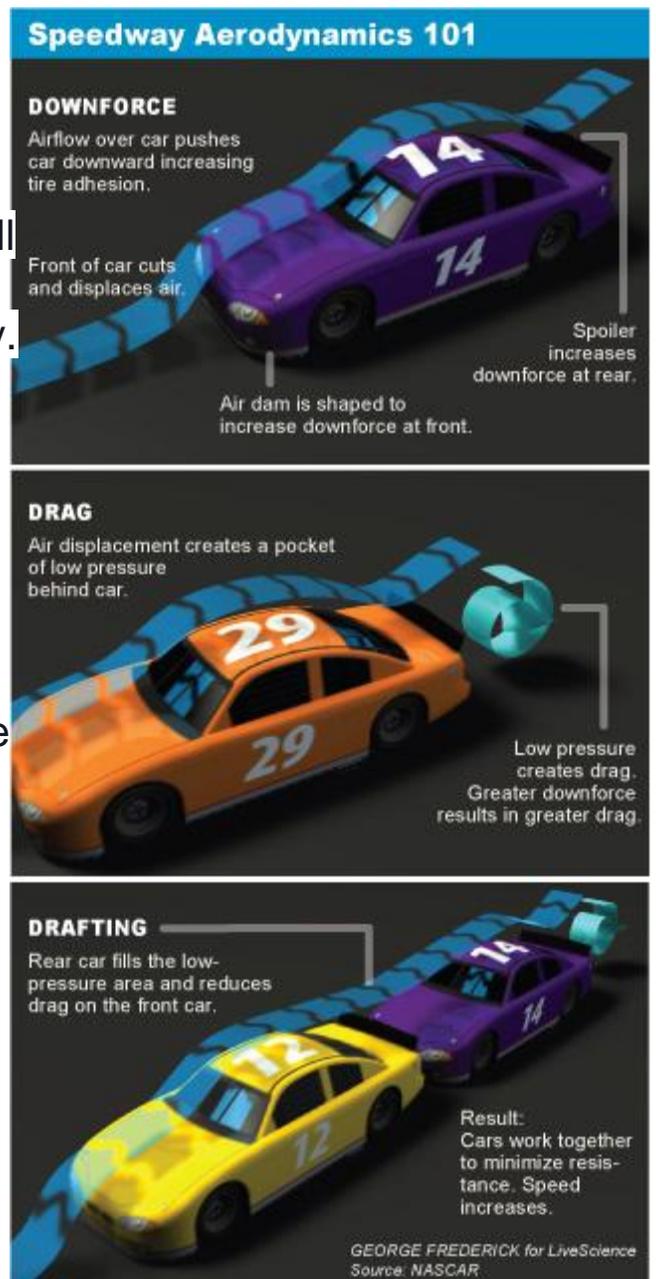


AERO 101

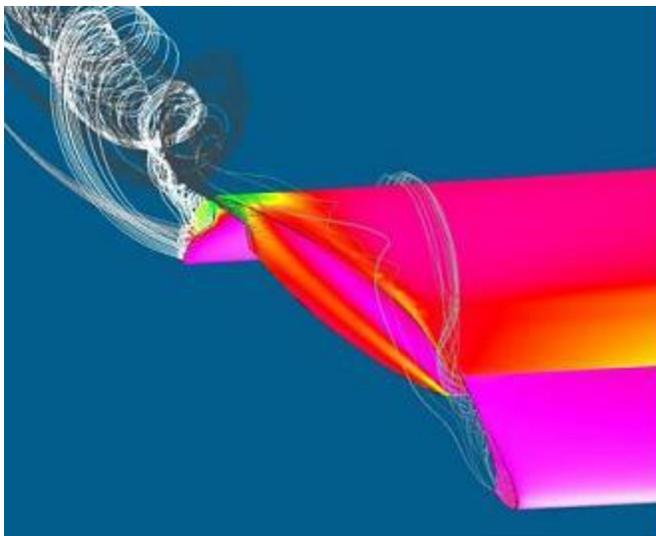
Hi guys, we're back! Today we will be covering drag and lift. There are different types of drag and lift, and we'll cover a few of them on here. As before, if you want to know something specific, comment below!

Drag

The first of the two components of aerodynamic force we will talk about is drag. The most dominant type of drag is referred to as form or pressure drag. This is the sum of all the pressure variations acting in the direction of airflow over the car's body. Form drag is most commonly caused by flow separations at the rear of the car, which result in lower pressures compared to the front of the car. How much form drag depends on the air's velocity and the size of the car. Skin drag or viscous drag occurs from the viscous air interacting with the surface roughness. Skin drag and form drag are often lumped together because they are both velocity dependent, especially when discussing wings, when the sum of the two is called profile drag. We'll cover that at a later time though.



Another important source of drag is known as vortex drag, or induced drag. This type of drag is associated with rotating vortices forming behind a wing or body that generates an aerodynamic lifting force (upwards or downwards). Vortices have 'cores' which are at a low pressure and will become a source of drag when acting on a rearward facing surface (like the rear bumper of a car). When designing a car to reduce drag, one must look at the basic shape of the car (a streamlined car or one with an elongated rear end will have a lower drag coefficient); the effects of the wheels (because wheels create drag too, known as tire drag); the effects of wings, splitters, etc; engine or brake cooling; and imperfections in the body (door seams, window seals, improperly fit panels).



Lift

How is lift created? Lift is created from the pressure difference that occurs when air traveling over one side of an airfoil (this is what a wing is, an airfoil) is faster or slower than air traveling over the other side. In regards to wings, the lift created is negative, and this is commonly known as downforce. Aside from wings, downforce can be created using the vehicles body as well. You can think of the relationship between the vehicle and the ground as a venturi tube. A venturi tube works by having a large

inlet, a narrow “throat”, and a large outlet, in which the air can diffuse (this is where the term diffuser comes from). As the air moves towards the throat, the pressure drops, increasing the velocity of the air. If the throat is too narrow, the effectiveness of the venturi is diminished. Just like the venturi tube, if a car’s ground proximity is too low, this will restrict the amount of air traveling underneath the car, which will reduce the venturi effect. Depending on the shape of the car, too low a ground clearance can actually create lift!

In race car design, teams usually put downforce production first, and drag reduction second. This is due to the many benefits downforce leads to, such as increased grip. The faster a car can corner, the faster it reaches the checkered flag.

