How Airbags Work

How does the airbag know when to deploy?
A collision can happen in milliseconds. An airbag needs to deploy even faster than that.

An airbag knows when to deploy because there are sensors located around the outside of the vehicle. These sensors keep track of changes in the car’s velocity. If a sensor records a big change in velocity, it can send an electrical signal to the airbag inflation device in as little as 0.015 of a second.

What happens when the inflation device is triggered?
In order to inflate the airbag that quickly, engineers have planted an explosive device in every airbag device. Imagine an explosion within inches of your face! This is what happens when the airbag deflation device is triggered.

A heating element heats up very quickly. This heats a chemical stored in the device, which is usually sodium azide (NaN₃). When this chemical (or a similar chemical) is heated, it explodes, producing nitrogen gas (N₂). The gas fills the nylon airbag. This allows the airbag to inflate at a rate of up to 200 mph.

The rate that the airbag inflates depends on the data that the airbag sensors record. A faster collision (shorter Δt) requires a faster inflation. The timing adjusts so that the airbag is beginning to deflate (get smaller) right as the person makes contact. The entire process from the triggering of the sensor to the beginning of airbag deflation lasts between 1/20 and 1/25 of a second.

How has airbag technology improved in recent years?
Today, there are several different types of airbags. In 1998, the government passed a law mandating that all automakers include driver and passenger airbags. This law applied for all cars, light trucks (including SUVs), and vans.

Since 2014, most new vehicles also have side airbags, even though they are not required by law. Vehicle companies use these types of airbags to meet new safety requirements from 2018 about preventing passengers from exiting the side windows in a collision.

Inflatable seat belts are like airbags that are attached to the shoulder strap of a seat belt. Inflatable seat belts are optional for third row seating on several car models, and some luxury cars come with them standard.

Are airbags safe?
Airbags reduce the risk of injury or death when used properly. To reduce risk, the person in the car should be at least 10 inches from the steering wheel. If the person is closer, there is a greater risk of injury. There are also special rules for children depending on their size and age. If a child is sitting in a seat with an airbag that is not designed for children, this can be dangerous. Make sure to know the airbag safety requirements for young passengers or small adults.
If a car has an airbag warning, it needs to be taken to a mechanic. There might be something wrong with the airbags. Check the automaker’s website to see if an airbag has been recalled. If you buy a car that has been in a wreck, take the car in to get the airbag systems checked.

Consider the following questions:

- Why would automakers design airbags so that they are beginning to deflate when a person makes contact with them?
- Why would a person not want to hit a fully inflated airbag or an airbag that is being inflated?
- Some airbags are standard, and others are optional. How does this impact some people differently than others?

Record your responses in the space below:

Record new questions that the reading raised for you, one per sticky note. Stick these to the bottom of the reading. We will share these at the start of our next class.

Adapted from the following resources