After veering into a ditch during an afternoon drive in 1952, an industrial engineering technician named John Hetrick drew inspiration for vehicle safety from an unlikely source; the inflatable, protective covers used on Navy torpedoes. He sketched designs for ways to provide vehicle occupants with similar inflatable, protective cushions during a sudden stop, to lessen the chance of injury.¹ This idea eventually became the “safety cushion assembly for automotive vehicles” patent,² issued for Hetrick’s idea in 1953 (US2649311A), and while several other inventions surrounding inflatable vehicle restraint systems were also in development, it wasn’t until the mid-1970s that the idea was commercialized with an “Air Cushion Restraint System.” Ultimately, it took forty years from the time of Hetrick’s fateful car accident for frontal airbags to become widespread in American cars.³

The National Highway and Safety Administration estimates that frontal airbags saved 50,457 lives from 1987 to 2017.

Advances in Airbag Technology

Standard airbags are designed to provide a soft cushion during a moderate to severe collision, lessening the chance that your upper body or head will make contact with the vehicle’s interior. They are considered a passive safety feature that gives added protection to supplement seatbelts.

The National Highway and Safety Administration estimates that frontal airbags saved 50,457 lives from 1987 to 2017. They are now standard equipment in all passenger cars, SUVs, pickups and vans. Also, many new passenger vehicles offer side airbags (SABs) as either standard or optional.⁴ Although not available in every car, consumers can find these four additional types of airbag systems on the road today.
1. Advanced Frontal Airbags

According to Safercar.gov, based upon sensor inputs that typically detect occupant size, seat position, seat belt use and crash severity, these airbag systems automatically determine “if and with what level of power the driver frontal air bag and the passenger frontal air bag will inflate.”

2. Knee Airbags

Designed to deploy from under the dash, these airbags help prevent common lower-leg injuries in crashes.

3. Front Center Airbags

While a frontal airbag is designed to prevent contact with the vehicle’s interior, this tubular airbag developed by GM is “intended to prevent front passengers from colliding with each other during side-impact crashes and to maintain occupant position in far-side or rollover crashes.” IIHS reports that Toyota has developed a similar system, only in the back seat.

4. Rear Inflatable Seatbelts

A cross between airbags and seatbelts, this safety system is designed to reduce head and neck injuries for rear-seat passengers and was first introduced by Ford in 2010.

As part of the overall active safety system, Mercedes has developed sensors to determine an impending impact and deploy airbags from underneath the car to slow it down and improve stopping power.

Airbags Move from Passive to Active Safety Systems

Future innovation in airbag technology is moving beyond reducing injuries. Mercedes is just one of the major auto manufacturers working on a way to move airbags away from solely a passive safety measure. As part of the overall active safety system, Mercedes has developed sensors to determine an impending impact and deploy airbags from underneath the car to slow it down and improve stopping power. Here are four other safety systems that offer the latest advances in airbag technology.
Airbags Take a Front Seat in Vehicle Safety and Collision Repairs
Author: Mitchell International

1. External Pre-Crash Side Airbag

Global technology company ZF calls its prototype “the world’s first pre-crash occupant safety system.” This technology heads off a crash by deploying on a vehicle’s exterior. “The vehicle uses radar, lidar and cameras to sense signs of a collision and algorithms to decide if a crash would occur” and deploys in the same amount of time it takes to blink.

2. Far-Side Airbags for the Vehicle Interiors

No less than one-third of all serious injuries or deaths suffered in side-on collisions are a result of collisions on the side of the vehicle opposite the passenger. ZF indicates they will begin series production in 2020 for airbags designed to support the head and upper area of the passengers involved in collisions on the opposite, or far-side of the vehicle.

3. Rear-Seat Frontal Airbags

To keep pace with front-seat protection, Mercedes is also previewing a concept where partially powered “tubular structures” inflate to cushion a rear-seat occupant’s forward movement in a frontal collision.

4. Panorama Sunroof Airbags

Similar to the design of a side-curtain airbag, Hyundai Mobis has introduced an airbag to prevent injuries related to a rollover crash.

The Challenges of Advanced Airbag Technology

Keeping customers safe is not only the concern of automobile and airbag manufacturers. Collision repairers also understand that customer safety is critical when servicing airbags and replacing them after deployment, though advanced airbag technologies can present challenges.

As John Huetter of Repairer Driven News writes, “Of course, proper sensor and module repair, replacement and recalibration will also take on an additional layer of importance, both in preserving the safety functionality of the system but also in ensuring it doesn’t fire for a false positive.”

Body Shop Business reported about a recent presentation by former SCRS chair Ron Reichen on the importance of performing physical post-repair safety inspections on things like belts, seat mounts and airbag wiring. “A scan might check out fine, but a physical inspection of airbag wiring would be the only way to reveal wires that were only partially connected after being strained by a crash—a situation that
could potentially lead to airbag system failure down the road.”

Proper and Safe Repair Imperatives

As with any automotive innovation—like ADAS technologies or special materials—advanced airbag technology has the potential to save lives. These advancements, however, also make repair processes more challenging, an important layer of consideration to ensuring proper and safe collision repairs, including airbag functions—putting accurate, up-to-date OEM repair procedures in front of repairers as seamlessly as possible. From parts to post-repair calibrations, it is imperative for technicians to have the right information at the right time if they are to perform proper airbag repairs. Armed with the right information, facilities can worry less about false positives or airbag failures and more about confidently returning vehicles to their customers.

Surely John Hetrick never imagined how widespread and advanced his idea for an inflatable cushion would one day become. Yet despite all of the advancements in airbag technology, and the increasing complexity in repair processes, vehicle manufacturers and technologists have never stopped working towards Hetrick’s original goal. Just like Hetrick, today’s innovators seek to use the latest technology to deploy a cushion of defense in the event of a collision. In other words, they intend to improve vehicle safety.

1 https://www.history.com/this-day-in-history/federal-legislation-makes-airbags-mandatory
3 https://en.m.wikipedia.org/wiki/Airbag
4 https://www.nhtsa.gov/equipment/air-bags
5 https://www.safercar.gov/Vehicle+Shoppers/Air+Bag+Advanced+Frontal+Air+Bags/#7
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10 https://www.repairerdrivennews.com/2019/06/05/zf-external-airbag-could-cut-side-impact-intrusion-30/
Airbags Take a Front Seat in Vehicle Safety and Collision Repairs
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15 https://www.bodyshopbusiness.com/dont-let-airbags-blow-up-in-your-face/