Airbags:

Your car's EXPLOSIVE guardian angels

You may not know it but if your car was built in the last 15 or so years, it will have at least two and maybe as many as nine highly explosive devices in the cabin! What? These explosive devices are the airbags – the so-called passive restraint devices designed to protect you and your passengers in the event of a collision. But don't worry about their incendiary nature – think of them as your guardian angels, ready to jump in between you and impending death.

by Dr David Maddison

Airbags are not passive! Well, they are passive in the sense that they sit there doing nothing – until they are triggered by the high g-forces of a collision. Then they rapidly inflate to cushion you against a collision with the dashboard or other parts inside the vehicle.

Most new cars sold in Australia have at least six airbags, such as the steering wheel (driver's) airbag, front passenger airbag, side airbags for front and back passengers and curtain airbags for front and back passengers.

There may (depending on the vehicle) also be knee airbags for both front occupants, a rear centre airbag, seat cushion airbags and rear window curtain airbags.

The purpose of the seat cushion airbag is to elevate the front of the seat to stop the passenger sliding forward in a collision. In addition, some vehicles may have a small airbag fitted to the seatbelt to more widely distribute the forces of the belt during impact. Also recently introduced are roof airbag designs and even external airbags to help minimise pedestrian injuries.

History of airbag development

While there are many mentions in automotive literature that airbags had their origins in 1941, I have been unable to find an original reference for this. It possibly relates to the practice of some WWII military pilots of inflating their life jackets to try to protect themselves in a crash.

The invention of the automotive airbag is generally credited to two independent inventors. American John W. Hetrick and German Walter Linderer had a US and a German patent awarded respectively within three months of each other in 1953.

Hetrick described what motivated him to develop the invention: *"In the spring*

The airbag timeline:

- 1953 Separate airbag patents by Hetrick and Linderer.
- 1964 US company Eaton Yale and Towne Inc. (now Eaton Corp.) start airbag research for school buses.
- 1964 Yasuzaburou Kobori in Japan starts development work on airbags.
- 1965 Ralph Nader releases book "Unsafe at Any Speed: The Designed-In Dangers of the American Automobile", highlighting problems of automotive safety, although it was heavily criticised for unfairness.
  See https://en.wikipedia.org/wiki/Unsafe_at_Any_Speed#Criticisms_of_the_book
- 1967 Cheap and reliable collision sensor developed by David Breed.
- 1968 Practical gas generating system developed by John Pietz.
- 1971 Ford builds experimental airbag equipped fleet.
- 1973 General Motors sells airbag equipped Chevrolet Impala only to government buyers.
- 1973 Oldsmobile Toronado first car with passenger airbag sold to public.
- 1974 Buick, Cadillac and Oldsmobile offer dual airbags as an option on several models.
- 1976 By this time GM had sold 10,000 airbag equipped vehicles but stopped selling them.
- 1980 Mercedes-Benz offer an airbag in Germany as an option on its model W126.
- Mid-1980's Ford and Chrysler introduce airbags.
- 1990 Ford makes airbags standard equipment on all its passenger vehicles.
- 1990 First recorded accident between two vehicles in which the airbags deployed to protect each driver.
- 1990 Airbags or automatic seat belts required on driver's side on all new US cars.
- 1995 Volvo offers side airbags and torso side protection airbags as an option on its 850 models.
- 1998 The US government mandates dual frontal airbags on all passenger vehicles.
- 2006 Honda introduces the first airbag for motorcycles, on the Gold Wing model.

of '52, my wife, my seven-year-old daughter, Joan, and I were out for a Sunday drive in our 1948 Chrysler Windsor. About three miles outside Newport (Pennsylvania, US), we were watching for deer bounding across the road.

Suddenly, there was a large rock in our path, just past the crest of a hill. I remember hitting the brakes and veering the car to the right. We went into a ditch but avoided hitting both a tree and a wooden fence.

As I applied the brakes, both my wife and I threw our hands up to keep our daughter from hitting the dashboard. During the ride home, I couldn't stop thinking about the accident. I asked myself: 'Why couldn't some object come out to stop you from striking the inside of the car?'"

Drawing from German patent 896,312 of 1953 by Walter Linderer. It was filed on October 6th, 1951 and granted November 12th, 1953. Loosely translated into English, the title of the patent is "Facility for the protection of passengers against injuries in vehicle collisions".

At the time, Hetrick was unable to get the auto-makers interested in his invention and he did not have the funds to develop it so nothing became of the idea.

Ford and General Motors in the US started experimenting with airbags (or inflatable restraints, as they were then called) in the late 1950s.

Both Hetrick's and Linderer's airbags were inflated with compressed air. But further research showed that compressed air was not capable of inflating the bags fast enough in the event of an accident and that the bag had to be inflated within around 40 milliseconds or less, which is the time between the original impact and passengers hitting the dashboard in a typical collision.

Practical airbags would also need a much more sensitive collision sensor than in the original Hetrick system.

In 1964 Eaton Yale and Towne Inc started doing airbag research to protect children on school buses. They were later approached by Ford to work on automotive airbags.

Pillow protects you in auto crashes

This "Auto-Ceptor" pillow is designed to prevent or lessen injuries in car accidents. Triggered by a crash sensor, it inflates in 1/25 second between the instrument panel and the driver and passenger. A model and dummy child demonstrate it here. It's a joint product of two companies: Eaton Yale & Towne and the Ford Motor Co.

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Auto-Ceptor experimental airbag as shown in the May 1968 Popular Science magazine.

They developed what they called "Auto-Ceptor" restraints. These airbags seemed to work well enough and used pressurised nitrogen (not withstanding other research suggesting that compressed gas could not inflate the bag fast enough).

In 1969 these airbags were taken to Washington DC to demonstrate to US Government officials but the system failed to activate during the demonstration. Henry Ford II was furious and temporarily cancelled the program.

In 1964 Yasuzaburou Kobori in Japan also started development work on an airbag "safety net" for which he received patents in 14 countries but died before seeing widespread adoption of airbags. See www.jahfa.jp/jahfa6/pala/person5-1.htm for more about him (use Google translate to convert the Japanese text to English).

David Breed developed a key component of airbag systems in 1967 in the form of the cheap and reliable "ball-in-tube" inertial crash sensor which he marketed to Chrysler Corporation.

This invention is frequently also attributed to Allen Breed (mentioned later) but it is believed that David Breed is the actual inventor.

Another important invention that made airbags feasible was a chemical system to generate large amounts of gas in a short time (ie, the explosive).

In 1968, John Pietz at Talley Defense Systems in the US developed a gas generating system based on the chemical reaction of sodium azide (NaN_3) and a metal oxide. It produces nitrogen gas as the reaction product which inflates the bag. Mainly due to the toxicity of sodium azide, other gas systems have now been developed and largely replaced sodium azide in modern airbags.

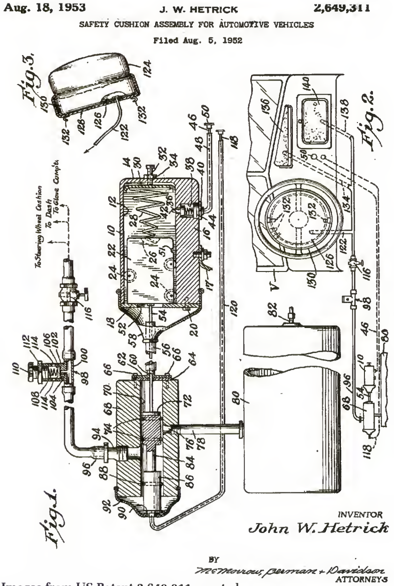
In 1971, Ford produced an experimental airbag equipped fleet of cars. This was followed in 1973 by GM producing a fleet of Chevrolet Impalas for use by the US Government, and in the same year GM offered an Oldsmobile Toronado to the public. Following this in 1974 Buick, Cadillac and Oldsmobile offered airbag options on various models.

When General Motors in the US first marketed airbags in the 1970s they were referred to as the "Air Cushion Restraint System (ACRS)".

Their original purpose was to replace seatbelts as there was significant resistance to wearing seatbelts in the US at that time. A corporate video of the time reflects their purpose as a seatbelt replacement or substitute.

See "*1974 Buick – Airbags*" https://youtu.be/ZyYdUQl-1WNc and the comments about the possible hazards involved in their deployment when children are in the car. Also see a modern review of the ACRS equipped car "*Air Cushion Restraint System – 1973 Chevrolet Impala Airbag*" https://youtu.be/XT1S14m3Qe4

Allen Breed co-patented an airbag which vented gas as it expanded, which reduced the rigidity of the airbag and injury from impacting it. This had been a problem in earlier airbags which did not deflate significantly.



Images from US Patent 2,649,311 granted August 18th, 1953 but filed August 5th, 1952, "Safety cushion assembly for automotive vehicles" by John Hetrick. Fig.1 shows the air accumulator and valve assembly. Fig.2 shows the relationship between the various parts including the "cushion" mounted in the steering wheel and Fig.3 shows the steering wheel mounted cushion and how other components relate to it.

The patent was awarded in 1991 and can be viewed at https://docs.google.com/viewer?url=patentimages.storage.googleapis.com/pdfs/US5071161.pdf

Why airbags work

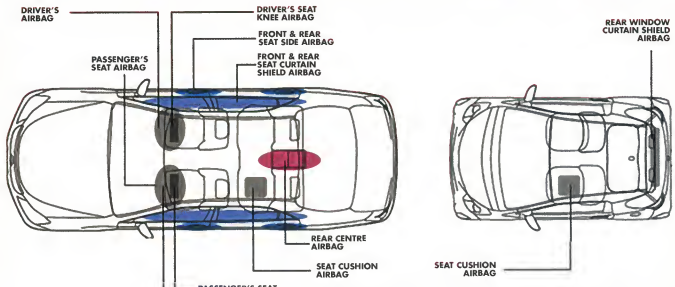
Airbags are designed to counter the consequences of Newton's First Law of Motion which describes the tendency of anything that is in motion to stay in motion.

The forward motion of a car has a certain amount of kinetic energy associated with it.

In the case of a car that is fine . . . until that motion comes to an unplanned and abrupt halt such as in a collision.

Modern cars are designed to absorb some of that kinetic energy by crumpling but the passengers too must have their kinetic energy absorbed.

Seatbelts (if they are worn) will restrain passengers to



The types of supplemental restraint system (SRS) airbags that may be fitted to modern vehicles. In addition to these bags there are roof airbags now available to replace some driver and passenger airbags and even external airbags to protect pedestrians.

a certain degree but mainly only the torso. Passengers' heads, arms and legs are still able to flail about and hit objects within the car such as the steering wheel, dashboard or windows.

When a severe collision is detected an airbag rapidly inflates and then deflates via holes in the bag. The energy of the passenger striking the airbag is absorbed via release of this gas.

If the airbag did not deflate, little energy would be absorbed and the passenger would just bounce off the airbag and little protection would be provided. Early airbags did not deflate significantly and were responsible for some injuries and deaths.

Note that US regulations require that airbags work with unbelted as well as belted occupants, making their design considerably more complicated.

In most other Western countries airbags are designed to work under the assumption that the passenger is wearing a seatbelt.

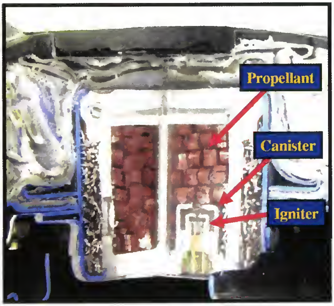
The airbag system

Airbags do not operate in isolation – they're a complete system, more often than not integrated with other systems within the vehicle. A basic airbag system consists of an airbag module, crash sensors, clock spring and an airbag control unit, or ACU.

The **airbag module** consists of one or more igniters, the propellant material which creates large amounts of gas to fill the airbag when it is ignited, a canister and the airbag itself. There are generally no electronics in the airbag module and it can be simply set off by supplying 12V to the igniters (see the panel "Interesting Videos" where some show letting off old airbags for fun).

Typically, Australian airbags are triggered when collision forces are equivalent to hitting a solid object at 25-50km/h, or 60km/h into another

(Above): an airbag gas generator module for a steering wheel airbag. Pellets are the propellant material. The two modules at the base either side of centre are the igniters. One or both of these are fired depending upon the severity of the crash. Surrounding the assembly is a strong canister. On the far right and the far left of the canister is a wire mesh filter. This stops particles from the gas generator exiting out of holes in the side of the canister (not visible) into the nylon airbag surrounding the canister (also not visible).
(Right): a view of a different steering wheel airbag module showing the relative position of the Nylon bag.



car, equivalent to forces of about 20g.

The front airbag generally inflates in about 65ms or less. The crash sensor takes about 12 to 20ms before an airbag deployment is triggered; side airbags inflate more rapidly.

The maximum pressure achieved inside a modern airbag is surprisingly low, about 34kPa, 5 psi or 0.34 atm.

This low pressure is due to the fact that even as the airbag is inflating it is continuously venting. If it wasn't vented, as early airbags were not, serious injury (or worse) could be caused by a far more rigid airbag.

The driver and/or passengers strike the airbags when they are at their maximum expansion. The airbags then rapidly deflate as gas is vented through holes facing away from passengers. As this gas is bled off, energy is dissipated. After the collision, the sequence is complete and the bag is fully deflated.

Modern airbags are frequently multi-stage, with one or more igniters to produce an appropriate amount of gas for the severity of the collision and the weight of the occupant as determined by weight sensors in the seat.

Airbags are typically made of Nylon fabric with a polyurethane coating (or more recently a silicone coating which is less affected by ageing).

As the airbag inflates, it bursts its way out of its container (such as the steering wheel cover). The bag is coated with talcum, French chalk or corn starch powder to help it unfold smoothly – this is the "smoke" that can be seen in some deployment videos.

Some airbag deployment videos as seen on driver's dash cams can be seen at "*Car airbag crash live video (Caught On Dashcam)*" https://youtu.be/ab2qLV547FA

Airbag crash sensors detect a rapid change in velocity and determine if a collision has occurred, the type of collision and its severity. The sensors also determine if the crash is frontal, sideways or rollover type.

The type of collision detected determines which (if any) airbags will be deployed – they will not be deployed for minor collisions and not all airbags will necessarily be deployed, even for more severe collisions. It depends upon whether the airbag will be helpful or a hindrance for the type of collision detected.

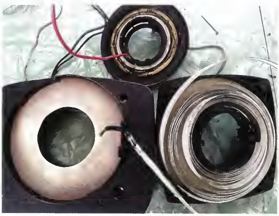
Note that normal braking, no matter how hard, will never cause airbag deployment.

The sensors are typically located in the front of the car for frontal crash detection (near the engine or passenger compartment or inside the ACU), the side of the car for side impact detection (in the door or door sill, between front and rear doors or the ACU) and for rollover detection the sensor will be located either near the car's centre of gravity or in the ACU.

Older technology airbag crash sensors were mechanical in nature such as the ball-type sensor and the roller-type sensor.

The next generation of technology were piezoelectric devices while the present generation are mainly solid-state MEMS (microelectromechanical systems) accelerometers designed to sense the high-G forces in typical collisions.

The sequence of airbag deployment for a steering wheel airbag.
(1st picture) A crash is detected and the airbag starts to inflate.
(2nd picture) The bag is fully inflated as the driver's face is just about to hit the bag.
(3rd picture) The driver's face hits the bag and it immediately starts to deflate
(Remaining pictures) Progressive deflation of airbag and rebound of driver's head.



Disassembled clock spring assembly from an Audi, as shown on forum post at http://forums.quattroworld.com/a6100/msgs/21794.phtml discussing the repair of this component. Note the coiled ribbon cable on the lower right. At the left is the top assembly that goes over the ribbon cable. This one has only two wires in the ribbon cable but there may be many more when there are a lot of controls or indicators on the steering wheel.

High speed thermal images of airbag at a particular instant during deployment showing side view, view of gases being vented from rear ports after deployment and frontal view.

MEMS devices have been in use since the mid 1990s. The mechanical devices were either off or on but the solid state devices can supply more detailed information about the nature of the collision and contribute to a more appropriate decision as to the deployment or not of airbags and other safety systems such as seat belt tensioners.

The clock spring is a component that provides the electrical connection between the car's wiring harness and the steering wheel airbag, allowing for an electrical connection between the stationary steering column and the rotating steering wheel.

It may also be used to provide a connection to other switches or indicators on the steering wheel.

The clock spring typically consists of a length of ribbon cable located between a small cylinder and a larger cylinder which is free to wind up or unwind when the wheel is rotated. It is a rather simple and elegant system.

For a video showing the location and inner workings of the clock spring you may wish to look at "*Clock Spring Replacement - Toyota / Lexus*" https://youtu.be/862izi6XChI

The **airbag control unit** (ACU) is a form of electronic control unit (ECU), which in turn is simply an embedded system that controls various subsystems within the car.

The ACU is the "brains" responsible for control of the airbag system. It tests the airbag system at start up and monitors various sensory inputs while a car is in operation.

Sensors monitored include crash sensors, gyroscopes, speed & brake sensors, and sensors to monitor the occupancy of a seat and the weight of the person in it.

Rollover detection requires the use of a gyroscope and low g-force sensors. The combined data from the gyroscope and low g-force sensors is used to determine the angle of the car and rotational rate, thus enabling the ACU to compute the optimal time to deploy the airbags and other systems such as seat belt tensioners.

In a given crash scenario, not all bags will necessarily be deployed – for example, bags associated with unoccupied seats will not be activated.

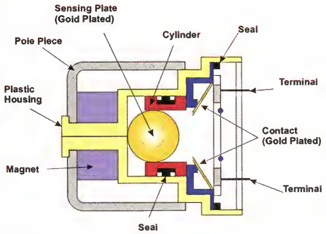
Also, airbags are not deployed if such deployment would cause injury, for example, if there was a child seat present or there was an out-of-position passenger, as determined by seat sensors, the relevant airbags would not be deployed.

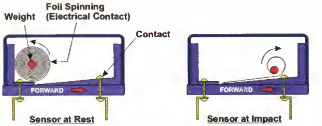
There is no universal algorithm to establish airbag deployment or non-deployment. Each car model needs to have its own algorithm, tailored to suit the specific needs of that model of car, based upon crash simulations and testing.

Efforts are underway to develop neural networks to provide smarter more effective airbag deployment and control with more universally applicable algorithms.

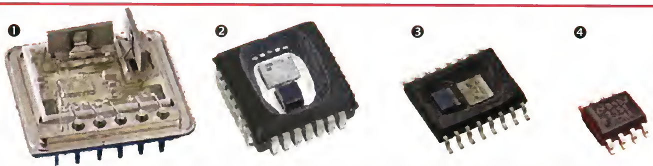
In the event that the vehicle battery becomes disconnected during a severe crash, most modern airbag control units have backup power available, usually in the form of a large capacitor, such as the 33,000µF capacitor in the ACU of a first generation US model Mazda MX-5 Miata.

Backup power for ACUs is said to typically last from a few seconds to up





(Above): roller-type sensor. There is a weight on a spring which, upon impact rolls to the right. If the impact is severe enough, causing the weight to roll far enough to the right, an electrical circuit will be completed. This will be sensed by the ACU, which decides whether to deploy the airbag or not. (Left): ball-in-tube type sensor. Upon impact, the ball shifts to the right and connects to contacts, which complete an electrical circuit which is sensed by the ACU and a decision is made whether or not to deploy an airbag.



Evolution of high-g force solid state crash sensors for airbags. These are designed to be sensitive to the high g-forces in typical collisions. (1) Hybrid piezoelectric device in use from 1984 to 1997, (2) solid state silicon MEMS micromachined capacitive device (1997 onwards), (3) smaller form factor MEMS silicon capacitive device (2002 onwards), (4) present generation MEMS device with further reduced package size.

to ten minutes after loss of main vehicle power and allows for the airbags to still be deployed.

Most airbag electronic control units use the CAN (Controller Area Network) that is commonly used in all control and communications systems in modern cars.

Event data recorder

Nearly all modern cars have an event data recorder (EDR) associated with the ACU. This runs in a loop mode, recording various data at the time of a crash, such as speed, brake position, steering angle, whether seat belts are buckled and so on.

This data recording has raised privacy concerns in various jurisdictions and has been used to convict people of driving offences, including in NSW.

Nevertheless, questions remain about who owns the data and who can rightfully access it.

As of 2014 every major company selling cars in the USA had EDRs except for VW, Maserati and Ferrari.

There are companies in Australia that will read EDR data for prosecuting authorities and insurance companies. In the US there are companies that will delete EDR data upon request.

Roof and front-seat mounted rear airbags

Former spacecraft manufacturer and now major automotive eqipment supplier, TRW, has recently developed and introduced a roof airbag.

Its main purpose is to make more space available in the vehicle's dashboard, thus allowing for more instrument panel space, multimedia displays, storage space and also the possibility of reducing the overall size of the dashboard.

The bag is mounted in an enclosure above the windscreen. As well, a version has been developed for rear seat passengers with the airbag mounted on the back of the front seats.

Airbags to protect pedestrians

Volvo have developed an external airbag to minimise injury to pedestrians that may be struck by a car.

This system was introduced with the 2012 Volvo V40. For a video of the system in operation and other details see: "*Volvo V40 Pedestrian Airbag*" https://youtu.be/w2pwxv8rFkU

TRW have also developed an external side airbag to minimise forces of a side impact. See video: "*Car Tech 101: External airbags (On Cars)*" https://youtu.be/XrcbAcfXvUo

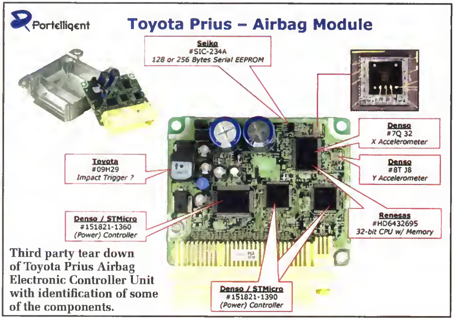
Non-automotive airbags

Apart from their most common application in cars, airbag safety technology is also used in some motorcycle jackets, motorcycles and aircraft.

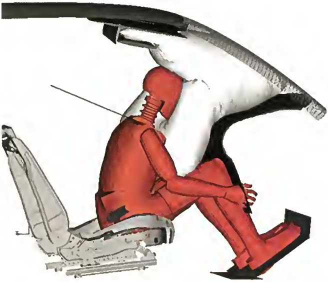
Motorcycle jacket airbags

Some motorcycle jackets now have

Bosch solid state MEMS gyroscope and low g-force sensor for rollover detection.



Third party tear down of Toyota Prius Airbag Electronic Controller Unit with identification of some of the components.



(Above): centre airbag to stop passengers hitting each other in the event of a side impact.

(Right): simulated deployment of TRW roof airbag as used in the 2014 Citroën C4 Cactus.

built in airbags that inflate when a collision event is detected. One example of a commercial jacket is the D-air Misano 1000.

This jacket, unlike most others, has no connection to the bike and has its own built-in sensors which determine when the airbags should deploy. See corporate video: "*Dainese How to: D-air Misano 1000*" https://youtu.be/nJeKJgUNSHk

For amateur video of a crash where a rider was saved from injury while wearing another brand of airbag jacket see "*Motorcycle Crash with a Rider wearing Helite Airbag Protection*" https://youtu.be/jdH8e22x74Q

Motorcycle airbags

Since motorcycles are one of the most dangerous forms of road transport, any improvement in road safety is beneficial.

In head-on impacts of motorcycles with other objects the rider tends to keep moving forward and strikes parts of the motorcycle as well as the object being struck at pre-crash speed. The objective of any restraint system would be reduce the speed at which the motorcyclist strikes the opposing object.

It may seem surprising to some that airbags have actually been fitted to motorcycles. Crash tests were done as early as 1973 that demonstrated that an airbag could reduce injury although the overall results were not considered entirely satisfactory. These tests were followed up in the UK in the 1990s.

In the UK tests it was shown that a motorcycle airbag placed in front of the rider in a way that the rider would strike the bag with their head and chest rather than the motorcycle or opposing object was highly effective up to speeds of 48km/h but full restraint of the rider was not possible beyond that speed, although there was still a beneficial safety affect. Tests showed a reduction in kinetic energy of the rider of between 79% and 100% and reduced neck injuries.

In the UK study it was noted that approximately 75% of motorcycle accidents occur at motorcycle impact speeds

Front seat mounted airbag for rear seat passengers.

(Above): 2013 Volvo V40 showing pedestrian air bag which also raises the bonnet when activated.

(Right): Experimental external airbag by TRW. It is expected to reduce side impact forces by 30 percent. It has a volume of 200 litres and will take longer to inflate than normal airbags so it has to be trigged even before the collision occurs.

of up to 48km/h, and 96% up to 64km/h and that 93% of the serious and fatal head injuries occur at speeds of up to 64km/h.

It was also noted that a majority of fatal and serious head and chest injuries occurred in roughly head-on impacts of the motorcycle and something else and that a majority of accidents with an opposing vehicle occur with the speed of the opposing vehicle at 25km/h or less.

In the light of these statistics it was decided to optimise the design of an airbag system for head-on impacts of the motorcycle into stationary or slow moving vehicles of up to 25km/h with additional injury reduction potential for impacts up to 64km/h. It is assumed these figures are for the combined speeds of both vehicles.

Honda has had an airbag installed on their Gold Wing model since 2006. For a video see "*Honda Goldwing Airbag System*" https://youtu.be/-1wS5XxuT30

Aircraft airbags

A number of commercial airlines use airbags. First introduced in 2001, they are attached to the seatbelts and tens of thousands are in current use. The bags are designed to fill the void between the passenger or pilot and the seat, bulkhead or instrument panel in front of them. For a video see "*Amsafe - How Seatbelt Airbags Work*" https://youtu.be/lZfPJG3LXxk

Military helicopter airbags

The US Army undertook an upgrade program of the Bell OH-58D helicopter to become designated the OH-58D(R) Kiowa Warrior and included many safety and other improvements including pilot airbags.

Anglo-Italian company Aero Sekur have developed external airbags for helicopters to increase survivability in the event of a forced landing on land or sea as well as providing floatation at sea.

D-air Misano 1000 motorcycle jacket with airbags and built-in crash sensors.

Safety improvements due to airbags

According to the Australian Government's Bureau of

Test of early motorcycle airbag on a Norton Commander in a frontal collision with side of car. UK Transport Research Laboratory and Lotus Engineering, report published 1996.

Interesting Videos

Here are a few videos on what is involved in replacing or repairing airbags that have been deployed.

These are included here for general information (and in some cases entertainment!) only – SILICON CHIP strongly recommends against doing this yourself and it may even affect your insurance coverage.

The point of presenting these videos is to show some of the inner workings of the airbags and what is involved when a professional replaces them.

Also note that in many late model cars the vehicle computer has to be reset after an airbag deployment has been made and crash data is also recorded. There are a couple of videos on that as well.

Apart from that, the strength of the collision that is required to deploy an airbag is significant and it is likely that there is other serious damage done to the car.

This may not be the case in other countries such as the US where airbags are designed to deploy at lower roads speeds than in Australia since in the US there is a higher likelihood that someone may not be wearing a seat belt and the airbags have to protect an occupant who may not be wearing one.

This perhaps explains why there are a number of US videos about replacing airbags – an airbag might be deployed at relatively low road speed with relatively minor vehicle damage.

"*How to detonate an airbag, airbag repair, and demonstration*"
https://youtu.be/8Fxr-dRikIE

"*HOW TO FIX AND REUSED A DEPLOYED AIRBAG*" (sic)
https://youtu.be/pAZ41pKbKAo
(Definitely don't try this!)

"*How to Replace an Airbag on a Vehicle*"
https://youtu.be/Hadsvt17Fj0

"*Carprog setup, Airbag resetting*"
https://youtu.be/9cJjZo3QWLU
(Silent)

"*How to Reset / Repair clear the crash data from GM Airbag control module*"
https://youtu.be/9dRR9Ytd7So

At the risk of being accused of being irresponsible for including these, some entertaining videos of people deliberately setting off surplus airbags can be seen here:

"*Setting Off Airbags*"
https://youtu.be/k31V0NvFXdg

"*THE BEST AIR BAG EXPLOSIONS 2013*"
https://youtu.be/JBcvwWUZ0PA

Aero Sekur external airbags on a helicopter. The system was showcased at the 2010 Farnborough International Airshow but does not appear to have been commercialised.

Infrastructure, Transport and Regional Economics (publication ISSN 1440-9593 information sheet 68), front airbags are estimated to have reduced light vehicle fatalities by 13% and side airbags have reduced fatalities by 4%.

But other research quoted in that document makes an assumption that front airbags reduced fatalities by 25% for drivers and 20% for passengers in front impact crashes.

It is difficult to ascertain the exact impact of airbags because they have accompanied many other safety upgrades in cars.

Two major Australian automotive insurance companies were contacted by SILICON CHIP to ask about whether personal injury costs had decreased as a result of airbag use and what change there had been in car repair costs associated with airbags but the information was not provided.

The future

We will see more airbags and more sophisticated airbags installed in cars and other vehicles.

New crash sensing algorithms, such as those based on neural networks, will also be developed to allow more intelligent airbag deployment.

Airbags combined with other safety systems in modern cars will see driving become even safer but it should not be forgotten that the ultimate responsibility for safer driving resides with the motorist. SC

Amsafe seat belt airbag in crash simulation with aircraft bulkhead in front of passenger.