

**THE TRAGEDY OF AIRBAG FATALITIES  
TO CHILDREN AND SHORT DRIVERS,  
AND HOW TO REDUCE THE HAZARDS**

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**INTRODUCTION**

The advent of airbags in our cars, pickups, and vans has been a major safety advance that has saved many lives in frontal collision accidents. But there has also been increasing evidence and extensive case examples that demonstrate a downside: Some passenger-side airbags have caused severe to fatal injuries to children in the right-front seat, and some driver airbags have caused severe to fatal injuries to short women drivers.

Arising out of a 1991 Congressional mandate, all vehicles sold in the U.S. must have dual airbags (for driver and passenger) as of the 1998

model year. Since virtually all manufacturers have already complied, the U.S. fleet has been adding about 14-million dual airbag vehicles each year. The media has been informing the public about the fatal accidents due to airbags, and the public has justifiably reacted with confusion, anxiety, and even skepticism about airbags. Are they life-savers, are they killers, or can they somehow be both? What are the facts, the circumstances, the defects, and the solutions that need to be understood and resolved?

**AIRBAG FATALITIES TO  
CHILDREN**

A major airbag problem concerns the continuing epidemic of severe to fatal injuries to infants and young children who are in the right-front passenger seat of a vehicle equipped with a passenger-side airbag. At a National Transportation Safety Board (NTSB) hearing in September 1996, it was noted that there were 26 documented cases since 1993 in which infants and young children had been killed by passenger-side airbags in collision accidents that they otherwise would have likely survived with either minimal or no injuries. Many of the collisions were at very low speeds, in the 8 to 20 mph range. The tragic epidemic continues at the rate of approximately one additional child fatality per week.

The critique of why children were being killed by airbags focuses on a few key issues, some behavioral and some technical. Though recommendations were typically expressed that children should always or preferably ride in the back seat, it was often difficult for the parent to place the infant where he or she was not immediately accessible next to them. As for young children, ages 5 to 12 years or so, it's understandable that parents would allow them to ride in the right-front seat, since the lap and shoulder belt appeared to be fit well enough... and they'd also enjoy *the added protection* of the passenger-side airbag, or so it quite logically seemed.

The passenger-side airbag bursts or explodes from the instrument panel at speeds from about 90 miles per hour to 210 miles per hour. The rapidly-inflating airbag can impact the passenger with a force as high as about 2,000 pounds. As it fully inflates, the airbag's maximum distance extending horizontally rearward from the instrument panel can be as much as 18 to 24 inches toward the child or safety seat.

Some airbags are stored in the front face of the instrument panel, and inflate *horizontally* directly toward the passenger. If it's a small child or a rear-facing infant seat, the horizontal deployment is aimed directly at the head of the small child or directly into the infant seat. Other airbag designs are stored atop the instrument panel, and initially inflate *vertically* upward and then wrap over toward the seated passenger. From evaluating the prior research and also the current knowledge about which *specific* airbag designs are causing fatal injuries to children passengers, it is rather clear that the horizontally deploying airbag designs (e.g., in some models by Chrysler, Ford, GM, etc.) are the lethal ones, while the top-mounted vertically deploying airbag designs (e.g., in some models by Honda, Toyota, Subaru, etc.) are significantly safer and non-lethal.

If pre-crash braking is involved, the child may also be moving toward the instrument panel. And if the

right-front passenger seat is not adjusted to its maximum rearward position, the closeness to the airbag is further aggravated. Even if the child is wearing the lap-and-shoulder belt, a combination of poor belt performance (too much slack, slow lockup response), and possible forward adjustment of the seat, the airbag could nonetheless still cause a fatal blow.

The exploding airbag delivers a massive blow to the young child's head, causing instantaneously severe to fatal brain trauma. In some cases, the fatal injuries have occurred whether or not the child was wearing the seatbelt. The danger can be increased if the shoulder belt is not snug, or if the seatbelt has a slow response time before it locks up, or if the seat is adjusted forward. If there's an infant in a rear-facing child safety seat, the exploding airbag literally hammers and fractures the plastic cradle, which is positioned almost in contact with the instrument panel, and delivers a massive blow to the rear of the infant's head.

### **THE 1973 GM DUAL-MODE AIRBAG... AND CHILDREN**

It is ironic that the very first production airbag system, developed by General Motors and utilized initially in a test fleet of 1,000 specially-modified 1973 Chevy Impala 4-door sedans, did in fact

reflect GM's concern for the airbag's potential inflation hazard to children.

Thus, GM devised a two-stage inflation pressure system, which inflated "softer" in crashes from 12-to-18 mph, and "firmer" in crashes above 18 mph.. GM then offered their two-stage airbag system as a \$235 extra-cost option in some models of the 1974-75-76 Oldsmobile, Buick, and Cadillac.

*"Low speed detectors are designed to activate the total system in a frontal type collision with an immovable object, such as a wall, at about 11 m.p.h. When striking a comparable parked vehicle (which will move or crush), the low speed detector will activate the system at about 22 m.p.h."*

*"In more severe accidents the high speed detector will more firmly inflate the passenger system at about 18 m.p.h. when striking an immovable object, and about 36 m.p.h. when impacting a comparable parked car."*

General Motors early-1970's concern about the airbag's deployment effects on children was described in a 1974 GM report:

*"... work utilizing live baboons in laboratory experiments indicated a potential inflation hazard to small children who might be*

*out of the normally seated position. The result of this program also stimulated the redesign program for the passenger restraint system."*

*"The possible inflation hazard experienced with the first generation design was reduced by providing dual sensing of impact severity and control of cushion inflation. During impacts of low severity, a low inflation of the cushion would be used. For high severity impacts, a faster deployment of the air cushion was provided."*

*"An additional series of tests... indicated the second generation air cushion restraint would reasonably control the inflation hazard to small children."*

Thus, the 1973-1976 GM airbag system already had the safety benefits of a softer bag for lower speed crashes, and a firmer bag for more severe crashes. This is a 20-year-old feature that will soon likely be "re-invented" in order to help solve the dilemma of airbags that can and do kill children in the right-front passenger seat. The airbag's explosive dangers to children, described mostly as "out of position" children, was discussed in the '70's and '80's when some automakers were voicing opposition to airbags.

Yet, when it came time to implement airbags in the 1988 to

1996 era, virtually all automakers ignored the benefits of making airbag inflation pressures proportional to the severity of the crash and the weight of the person on the seat. Many automakers made the airbag's threshold actuation speed very low, in the 8-to-12 mph BEV (barrier equivalent velocity) range, possibly to make sure the airbag would always actuate in a frontal crash, so the automaker couldn't be blamed for the airbag failing to protect the occupant, whether they were seatbelted or not..

### AIRBAG INJURIES TO SHORT WOMEN DRIVERS

Short adult drivers, especially women, have been severely and fatally injured by the explosive force of a driver's airbag... even in low to moderate speed crashes. Because of their short stature, from perhaps 4'10" to around 5'4", shorter drivers need to adjust their seat virtually to its full forward position. This places their chest and head in close proximity to the steering wheel. And in the center hub of that steering wheel is the stored airbag, ready to explosively inflate in a frontal impact. The explosive inflation can move the unfolding airbag toward you at 120 to 200 miles per hour, and generate a force of 2,000 pounds.

Some of the initial accident case examples concerned shorter women drivers, sitting very close to the steering wheel, who were fatally injured when the explosive force of the airbag fractured their ribs, which punctured and tore their aorta. The crashes were moderate in nature, and the airbag was the needless cause of death in what would have easily been a survivable collision. Some of the women were shorter, older, and more frail... making them more susceptible to the airbag inflation forces breaking their ribs, tearing their aorta, and causing fatal injuries.

### **HOW AND WHY AIRBAG HAZARDS OCCURRED**

How could such a prominent safety technology as airbags be compromised, leading to needless deaths and injuries? Airbags are not a new development, despite the general public perception that airbags are a technology of the '90's. In fact, the development of airbags goes back to the '50's and '60's, when the earliest dynamic sled tests and car crash tests by GM and Ford showed their great promise to reduce traumatic injuries in collision accidents.

There was anticipation in the early-'70's that airbags would soon be installed. NHTSA had initiated rule-making, and the car companies in the U.S., Europe, and Japan were

all developing airbag systems for their vehicles. But top officials from Ford and GM and Chrysler went to the White House in 1971, and urged President Nixon to delay the then-pending auto safety standards, including the requirement for airbags. The game plan was to delay, delay, delay. A delay that lasted almost 20 years.

Thus, the pending 1970's requirement for airbags was politically shelved, and languished in limbo into the mid-1980's. There was nothing preventing car companies from installing airbags on their own. After a Supreme Court decision in 1983 forced NHTSA to re-examine their latest cancellation, the rulemaking process began again. NHTSA and DOT responded with a 1984 plan to link mandatory buckle-up laws to a decision about requiring airbags. But without waiting for a NHTSA mandate, Mercedes introduced airbags in some models in 1984, and Ford offered a driver airbag option in the 1985 Tempo.

Then in 1988, Chrysler began to promote airbags as a standard feature in most of their cars. This was a stunning turn-around by Chrysler CEO Lee Iacocca, who had railed against airbags for years... including his criticisms made in 1971 in the Oval Office to President Richard Nixon, who was thus encouraged to cancel an impending requirement for airbags to be phased in during the mid-1970's.

Again in his 1984 autobiography, Iacocca was highly critical of airbags, even granting "*they'll work in 99.99 percent of cases*". He feared the powerfully explosive airbags "*can also be dangerous*" and would also cause injury and death in some cases... and that airbags would therefore create a liability nightmare for the car companies.

In the 1989-1993 era, the news media began to report and dramatically illustrate that lives were being saved in head-on collisions, *thanks to airbags*, and the public demand for airbags began to gather momentum. With the simultaneous pressure from both a 1991 Congressional mandate and the upgraded Federal Standard, the race to install airbags swept across the auto industry through the 1990's.

Airbags are a proven live-saving and injury-reduction technology. Thousands of people have survived crashes, due to airbags, in which they otherwise would have likely died. The current estimate is that at least 500 vehicle occupants are saved from fatality injuries per year. As each year brings an additional 14 million airbag equipped vehicles onto our roads, the value of airbags to prevent severe to fatal injuries will obviously increase the number of survivors.

Yet, the advent of millions of airbag-equipped cars, pickups, and vans has led to a combination of

circumstances and accidents in which the airbag itself was the cause of the fatality. A short woman driver, perhaps somewhat slight of stature, sitting very close to the steering wheel... involved in a 15 mph frontal collision. A 6-months-old infant, in a child bassinette-type infant seat, on the right-front passenger seat, just a few inches from the dash panel. A 7-year-old girl, safety-belted on the passenger seat of a Chrysler minivan, in a minor frontal crash.

## **OVERVIEW OF AIRBAG COMPROMISES AND OMISSIONS**

Many of the fatal airbag accidents have been evaluated. The history of how airbags have been an on-again, off-again, on-again safety technology has been reviewed. The roles of the auto industry and the federal auto safety agency have been considered. Amidst the historical and present wealth of information, here's an overview of some basic compromises, omissions, and misjudgments that have caused life-saving airbag systems to also be occasionally hazardous to children passengers and short women drivers.

**Failure to design and test airbags for smaller women and children, instead of only for an "average man"**. When airbags were required to comply with FMVSS 208, the basic test was a full-front

impact of the vehicle into the concrete barrier at a speed up to 30 miles per hour, with injury limits specified for the head and chest of an unbelted 50-percentile adult male dummy, 5'8" tall and weighing 165 lbs.

Even though the automakers and NHTSA could have *also* specified a range of test dummies, including shorter women dummies and child dummies, the desire for simplicity and economy prompted only a single crash test using just that 50-percentile "average man". And the driver's seat was adjusted accordingly.

Starting with 1998 model year vehicles, some automakers are using "de-powered" airbags that inflate less forcefully. This came about when U.S. automakers asked to have the test requirement relaxed, being allowed to use a dynamic sled test instead of a crash test, and allow higher injury levels for the test dummy. Critics argued that such "de-powered" airbags would be less effective for larger adults in more severe crashes. Despite much criticism, NHTSA gave permission to allow such "de-powered" airbags, which some automakers are referring to as "Second Generation" or other term.

**Failure to set the airbag's actuation threshold speed higher, rather than as low as each vehicle manufacturer wants... sometimes too low.** There was no actuation

threshold speed specified below which the airbag should not inflate. At an auto manufacturer's own discretion, the threshold speed could be as low as 8 to 10 miles per hour... or as high as 16 to 18 miles per hour. In some cars, the crash sensors were located on a radiator crossbrace or bumper assembly, adjacent to or behind the front headlights. Some crash sensors featured a small steel ball held by a magnet. With sufficient deceleration, the ball would release from the magnet, move a very short distance, and bridge an electrical contact. The processed electrical signal would then cause the inflator propellant (such as sodium azide) to be ignited, instantaneously generating a large volume of nitrogen gas that inflated the stored, folded airbag.

The location and mounting of the primary crash sensors also could lead to triggering deployment when there was a jolt or minor contact damage to the vehicle underbody. Thus, the airbag system would be activated in many circumstances in which it was totally unnecessary... very low-speed accidents, hitting a curbing, or a minor "fender bender" or underbody-contact incident. There have even been reports that speed bumps have triggered airbags.

**Failure to have multiple inflation pressures, rather than just a single-mode high inflation pressure that's**

**too high for the less severe crashes.** Virtually all manufacturers adopted an airbag system that used sodium azide pellets to instantaneously generate a large amount of nitrogen gas that would immediately fill the stored airbag and burst it through its cover panel into a large, inflated, rigid pillow. The airbag would then deflate through side vents as the occupant loaded into the cushion. But once the ignition process began, the entire amount of sodium azide was activated, meaning the inflation pressure would always be the same... rather than a “softer” inflation for lower speed crashes, and a “firmer” inflation for higher speed crashes.

**Failure to use airbag tethers and shapes that would ensure a greater distance between the inflating airbag and the driver or passenger.** The speed of the inflating airbag is from 90 to 210 miles per hour, and can generate a force of 2,000 pounds. Tether straps are used inside the airbag to help shape the inflating bag and reduce the distance that the airbag inflates from its stowed position within the steering wheel hub and the instrument panel. Tethered driver airbag maximum distances from the instrument panel range from 12 to 15 inches, while untethered driver airbags range from 17 to 20 inches or more and thus can more dangerously impact into the chest and head of the short woman as the airbag explosively inflates. A similar situation exists for the

larger-size untethered passenger-side airbag... causing the airbag to explosively inflate and impact into the head of the child, causing severe to fatal brain and neck trauma.

**Failure to include a “seatbelt-in-use” detector switch to raise the airbag actuation threshold to a higher speed.** If the driver is wearing his or her lap-and-shoulder belt, then there’s less need for the “supplemental” airbag to inflate, especially in low to moderate speed crashes. But some automakers have provided seatbelts that fit poorly, or that have too much slack, or that don’t lock-up quickly enough in the crash. And most automakers don’t want the extra cost of using a seatbelt detector that will raise the airbag’s actuation threshold if it detects the driver is in fact wearing the seatbelt... such as from 12 mph if you’re unbelted, raised to 18 mph if you’re belted.

**Failure to provide the safer seatbelt pre-tensioners to snug the belt at the start of a crash.** Seatbelt pre-tensioners are devices that automatically take up any seatbelt slack, thereby snugging the lap belt and shoulder belt to the wearer’s body at the start of a crash. Snug fitting belts serve as a more effective restraint, keep the occupant from excessive forward movement, and prevent a looser-fitting shoulder belt from slipping off the occupant’s shoulder. Most seatbelt pre-tensioner systems also use a force-limiter feature that alleviates excessive loads on the



occupant's body during the crash. Most European cars and upper-scale Japanese cars use seatbelt pretensioners. The only American brand that presently includes pretensioners is the new 1997 Cadillac Catera, which is essentially a restyled Opel that's imported from Germany.

**Failure to recess the stored airbag a bit deeper, to allow more distance between the inflating airbag and the shorter driver.**

Recessing the stored airbag deeper below the plane of the steering wheel creates more distance between the explosively-inflating airbag and the driver, especially the shorter driver who sits very close to the steering wheel. Other techniques to alleviate the high inflation pressure burst is to inflate the airbag circumferentially, rather than a pressure force directed directly toward the chest or head of the driver or passenger.

**Failure to provide or offer a telescoping adjustment for the steering wheel.**

Include an adjustable telescoping steering wheel as a standard feature, so shorter drivers can adjust the steering wheel to be further away from themselves. This would create a safer distance between the explosively inflating airbag and the driver. Many steering wheels have a tilt feature, but not an ability for fore-and-aft telescoping as well.

**Failure to provide or offer an adjustable pedal platform.**

Include an adjustable pedal platform for the accelerator and brake pedals, to accommodate shorter drivers, and thereby reduce their need to adjust the driver's seat to a full forward position. Pedal extenders can also help make the brake and accelerator more easily accessible to shorter drivers. Pedal extenders are available at some of the companies that modify vehicles for handicapped persons. Saab has offered a pedal extender kit since 1994. The simplicity of pedal extenders can be compared to those that have always been widely used on children's tricycles and bicycles.

**Failure to provide sufficient warnings in highly-visible labels.**

Most vehicles have lacked the prominent display of highly-visible warning labels to alert the driver and passenger of the problems of sitting too close to the stored airbag, and of the need to always wear the lap-and-shoulder belt and keep it snug. Most vehicles have also failed to have prominent warnings about the dangers to infants in rear-facing child seats, and to small children in general.

It would also be appropriate to advise parents to preferably place their small children in the rear seat, securely belted, especially in those vehicles with passenger airbags that are mounted on the face of the dash and inflate directly rearward toward a small child's head, and with crash sensors that trigger the airbags in crashes as low as 8-to-12 mph BEV.

This are, unfortunately, other potential hazards that loom up when the child is placed on a rear seat, even if they are properly seatbelted or in a child safety seat. Many cars have only a lap-belt for the rear seat's middle position, and there have been many incidents of such lap-belted-only small children receiving severe abdominal and spinal injuries as they jackknife over the lap lap.

Also, too many front seats have very weak backrest structures, so that in a rear-impact accident, such backrests tend to collapse rearward. An adult in the front seat can therefore slam into the small child that may be seated directly behind him. The safety problem of seat backrests being so weak arises from the permissive nature of FMVSS 207, which requires a minimal static-load or "slow pull" test that's only 20 times the weight of the seat itself. There's no dummy on the seat, nor any crash test or dynamic sled test requirement. Some front seats are poorly designed with a support mechanism on only the outboard backrest support arm, while the inboard support arm is a free pivot that offers no support.

### **PROPOSALS TO HELP SOLVE AIRBAG PROBLEMS**

In efforts to alleviate airbag problems, some auto companies urged NHTSA to modify the applicable safety standard, FMVSS 208. Ford Motor Company wanted the compliance crash speed reduced down from 30 mph to 25 mph, and also permit acceptance of chest injury forces to go from 60g's up to 80 g's. This would allow the automakers and airbag system suppliers to "depower" the airbags to make them 20-to-35-percent less forceful when they inflate. This could likely be accomplished by simply using less sodium azide propellant in the inflator cannister, for example.

General Motors also urged that a dynamic sled test, simulating a typical 30 mph vehicle-into-barrier crash test, be utilized as the only compliance test. Therefore, as Ford and GM and some other automakers argue, the lowered test requirements and more-permissive injury criteria would allow them to use an airbag that deploys with less force, which would supposedly reduce the injury potential to children.

Yet, as NHTSA and some automakers admit, reducing that particular FMVSS 208 crash test requirement may *increase* the injury potential for the larger adults. And using a sled test instead of an actual vehicle crash test, will take away the reality of evaluating the total vehicle's crashworthiness performance (e.g., how the windshield pillar moves

toward the driver's head, or how the floorpan buckles at the driver's feet, or how the steering column re-orientes upward toward the driver's neck).

Despite these actual and potential negatives, NHTSA has modified its rule to allow the depowering of airbags. Ford Motor Company announced that most of its 1998 models include depowered airbags, which Ford refers to as "Second Generation" airbags.

Instead of weakening FMVSS 208, the standard needs to be upgraded and made more inclusive toward protecting children and shorter drivers. NHTSA needs to expand the crash test matrix to include 5<sup>th</sup>-percentile women drivers, and infants and small children on the front passenger seat. NHTSA needs to establish a minimum speed below which the airbags should not inflate, and/or if an infant carrier or child safety seat is in the passenger position.

NHTSA needs to encourage airbag inflation pressures and manner of inflation so that the airbag inflation is more proportional to the crash severity ("soft" and "medium" and "firm"). Airbags can be inflated in a less severe manner, such as by filling various internally-connected compartments in sequence, or by circumferential or radial filling, rather than a single rearward burst into a single-chamber airbag.

NHTSA needs to mandate or encourage adoption of seatbelt pretensioners, which automatically tighten or snug the lap belt and shoulder belt at the very start of the crash. NHTSA needs to require frontal offset crashes at speeds of 40 mph, which are more realistic to actual accidents, rather than the car's entire front crashing into a flat-faced barrier at only 30 mph.

The automakers should expedite the development and mass-installation of the best "smart" airbag system. They should use sensors to determine the weight of the occupant (or child safety seat) on the seat. They should use sensors to determine the relative severity of the impact, and cause the airbag to inflate in proportion to that crash severity and relative to the weight of the occupant.

It appears appropriate to "*re-invent*" an even better version of the 1973-thru-1976 GM dual-mode airbag system which had *both* a "*softer*" inflation and a "*firmer*" inflation, depending on the speed of the crash.

Innovative sensors can lead to an slower-inflation rate airbag that is thus less explosive and less likely to cause injury. Present-day airbags require the sensing, actuation, and inflation to take place within about 30 to 40 milliseconds. The need for such rapid airbag deployment requires an explosive airbag, so it's inflated before the occupant moves significantly forward in the frontal

collision. If the sensing could take place *even before the crash began to occur*, that would allow more time for the sense-actuate-deploy sequence to occur. That would enable a slower, safer rate of the stored airbag to become fully inflated.

Toyota had developed and tested such a pre-crash sensor system... back in 1970. The Toyota airbag system employed a radar sensor device and a small computer to sense and measure the distance between the car and the on-coming obstacle. The earlier decision to trigger the airbag allowed greater time to inflate the airbag... thus it could inflate with less explosive force. Toyota's car-into-barrier crash tests demonstrated the merits of such a pre-crash sensor.

### AIRBAG "ON-OFF" SWITCHES

Some automakers want to include an "on-off" switch to allow parents to turn off the potential activation of a passenger-side airbag. That would introduce the danger of their failure to turn the airbag back on, to protect larger children, teenager, and adult passengers, especially in the more severe frontal impacts when the combination of seatbelts and airbags is most critically needed.

**A critical requirement for any airbag on-off switch would be to**

**include a *lighted visible alert on the instrument panel***, with an amber or red light and wording and symbology to clearly indicate that either or both the driver's and passenger's airbags have been turned off. A green light would indicate that the system is ready for actuation when appropriate. It's also possible to design the airbag system so that it automatically re-sets to a ready mode each time the car is started.

### TOWARD A SOLUTION: "SMART" AIRBAGS

The proposed solutions focus on what is called a "*smart airbag*" system, whereby the airbag inflation pressure, or even whether or not to activate, are automatically responsive or proportional to such factors as the speed of the crash and the weight of the person (child or adult) on the seat, their proximity to the stored airbag, and other variables.

Some proposed "smart airbag" designs include occupant weight sensors in the seat cushion to detect whether the right-front seat is occupied, and by how much weight (child, small adult, large adult). Infrared detectors can also determine whether or not there's a child safety seat present. If the sensors detect a potentially dangerous situation, such as the close proximity of a rear-facing child safety seat, the airbag is

disengaged and will not actuate in a crash.

Alternative proposals describe an airbag sensor that is able to also inflate the airbag in proportion to the severity of the crash... with a "softer" inflation pressure for lower speed crashes, and a "firmer" pressure for higher speed crashes. Some of GM's early-1970's dynamic sled tests and crash test studies using child dummies and live baboons indicated changes needed to reduce the potential of injury to children... and these improvements were incorporated in their "*Air Cushion Restraint System*" (ACRS) implemented in the 1973 Chevy Impala test fleet... making them the world's first cars with a "smart" airbag system.

The preferred solution is to expedite the development and mass implementation of "smart" airbag systems that can detect when a child or rear-facing child seat is in proximity to the passenger airbag, and cause softer inflation pressures in such instances, especially in low and moderate speed crashes. A parallel feature would sense when the seatbelt is being worn by the passenger, similar to a feature in some Mercedes airbag systems, which raises the airbag actuation speed threshold when the driver is seatbelted.

As discussed above, it is also important to locate the stored airbag module in such a location that the initial burst-out forces will

not be concentrated directly toward the head or neck of a seated child or small adult. Thus, the top-mounted vertically-deploying passenger airbags are a safer embodiment than the horizontally-deploying airbags that are located in the front face of the instrument panel.

Another feasible feature would sense when the driver's seat is moved forward, which allows the shorter driver to sit closer to the steering wheel. That forward seat position would in turn cause the airbag to inflate at a lesser power level, or not inflate until the crash severity exceeded 20 mph or so, depending also on whether the seatbelt was buckled.

## **VEHICLE CRASH RECORDER**

The severity of the crash and the various airbag control settings could be measured and recorded by a computerized airbag system recorder... much like flight recorders do in aircraft. Such data would provide useful real-world collision accident information that would help analyze what actually happened, such as measured deceleration and velocity changes. They would also provide helpful information that would expedite the development of safer airbag and seatbelt restraint systems.

Volvo is presently using such crash recorders in an on-the-road fleet, to gain valuable data about the forces and restraint performance in actual accidents already include sensors and computerized data storage units to continuously record vehicle performance data, and specific crash data when the a. Many present-day airbag systems irbag is triggered in a collision accident. It would be fairly easy to upgrade such systems into full-time crash recorders.

What do you tell owners of airbag-equipped cars, pickups, and vans ?

**Is it safe for short women to drive ?** Yes, but adjust the driver's seat to be as far rearward as possible to ensure at least 10 inches between the steering wheel hub and the driver's chest (sternum). If necessary, recline the backrest a bit more.

**Can children still ride in the right-front seat of a car equipped with a passenger-side airbag ?** Yes, but only if the child is large enough to properly use the lap and shoulder belts. Use a booster seat if necessary for smaller children. And adjust the passenger seat as far rearward as it will go. Infants and small children (less than about 60 lbs.) should preferably ride in the rear seat, and be buckled in a child safety seat that, in turn, is properly belted to the car. Note that some cars have front seats with weak backrests that can collapse rearward in a rear-impact accident, causing the front seat adult

occupant to slam rearward into the small child on the rear seat.

**Should you try to disconnect the airbags, and who would do it for you ?** No, it's illegal for a car dealership to disconnect any safety-related equipment. And a mechanic may not do it correctly, nor would you yourself. And you'd negate the potential life-saving benefits of airbags if you should subsequently be in a 20-mph or higher speed crash.

**Should you buy a current vehicle with airbags for the driver and passenger...** Or should you wait perhaps two to four years or so for the "smart" airbag systems to be developed and produced ? Don't put off buying an airbag-equipped car, pickup, or van. The proven benefits of airbags to protect you in the vast majority of crashes far outweighs the few circumstances in which airbags can cause injury.

Airbags are marvelous safety devices that will continue to save many lives in collision accidents. The serious concerns about airbags causing severe to fatal injuries to children and to shorter drivers ***must be expeditiously addressed and corrected.*** So-called "smarter" airbags systems could and should have been implemented many years ago. They should now receive the highest attention by the auto manufacturers, the airbag system manufacturers, and the National Highway Traffic Safety Administration.

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