

# Safety or Profit: Ford's Rollover Protection System

by John D. Rowell

It seems all too frequent that we hear of a vehicle manufacturer that ignored the advice of its engineers, and in search of greater profits, deliberately decided to avoid use of a safer design or a more solidly constructed part. Ford has a long history of being called to task for such conduct. It appears to have happened again. In particularly egregious fashion, Ford decided not to include rollover occupant safety features on a vehicle known for its rollover propensity, the Explorer. Not only was the safety feature relatively inexpensive, it was provided to European customers as standard equipment. In the United States, Ford sought to increase revenues on its most profitable vehicle, the Explorer, by making customers pay for the safety feature as a \$560 option. While the actual part cost is not available for publication, one on-line parts supplier has estimated the increased part cost to be about \$33 per vehicle (based upon an average of other curtain airbag systems). People have been killed and catastrophically injured in Explorers whose owners were quite understandably unwilling to pay \$560 for \$33 in parts.

In 2000 and again in March of 2001, Ford announced that it would implement an integrated Rollover Occupant Protection system in the 2002 model year Ford Explorer. Ford called the system the Safety Canopy. The system was to employ rollover sensors, side curtain airbags, seat belt pretensioners, and cold gas inflators (allowing inflation to be maintained up to six seconds). The announcement was well timed. The Explorer had been the subject of multiple recalls and NHTSA advisories the summer of 2000. That summer, the Explorer/Firestone rollover problems were the subject of Congressional investigation, leading to enactment of the Tread Act.

However, consumers did not see the Safety Canopy, even as an option, on any Explorer until mid-2002, at the tail end of production of the model year 2002 Explorer. Until model year 2007 Ford offered the Canopy System only as an option on the Explorers sold in the United States. The price was about \$560, most of which was profit. The Safety Canopy was, however, offered as standard equipment on the European version.

Predictably, model year 2002-2006 Explorer owners have been injured in rollovers in vehicles not equipped with Ford's Safety Canopy. Some who have suffered injuries the Safety Canopy would have prevented argue Ford, once again, put profits ahead of safety. They decry Ford's decision to implement the system as a costly option in the United States version while including the system as standard equipment in Europe and other countries. According to Ford witnesses, the decision to charge its United States customers for the same equipment it included as standard in the foreign version of the Explorer generated up to \$40,000,000 in revenue. Sadly, much of the material (internal Ford documents, Ford's discovery responses and testimony of Ford management) supporting such claims are hidden from public view, covered by protective orders secured by Ford's lawyers. However, even public documents and the deposition testimony not covered by protective orders is quite damning.

This article will describe the need for and benefits of this type of system and take the reader through a little of the history of development and implementation (based upon non-protected materials).

A brief description of the operation of airbags is probably in order at this point.

## Front Airbags:

In frontal crashes, the occupants inside the vehicle do not stop immediately, but continue moving forward. Frontal airbags are designed to protect the heads and chests of occupants from hitting the steering wheel, instrument panel, or windshield and to prevent excessive head rotation over the seat belt

shoulder harness. For airbags to be effective they must deploy early in a crash. In a frontal crash this typically occurs within the first 50 milliseconds (0.05 seconds). Late deployment of an airbag can be catastrophic. In order to try to avoid such consequences, newer airbag algorithms incorporate a "time out" which tells the system not to deploy if it hasn't done so within a certain time of the beginning of deceleration.

Originally, frontal airbags were designed to inflate only in moderate to severe frontal crashes. By the 1995 model year, virtually all cars and many light trucks had driver airbags. By the 1997 model year, most also had passenger airbags. Since the 1999 model year, the federal government has required automakers to install driver and passenger airbags for frontal impact protection in all cars, light trucks, and vans.

Advanced or "dual stage" airbags have been required in all passenger vehicles effective model year 2007. Advanced airbags are designed to suppress deployment if weight sensors in the seat detect that a front-seat passenger is small or in a child safety seat. Advanced airbags also can deploy at a lower energy level or pressure when passengers are small or out of position, or if the crash is of low severity.

### **Side Airbags:**

Side airbags are important for passenger safety in side impacts where a properly belted occupant can be struck by an intruding vehicle or object coming from the side. Side airbags that offer head protection are particularly important because they may be the only thing between an occupant's head and the front of a vehicle, a tree or other object, or the ground in the event of a rollover.

Because of the small space between an occupant and the side of the vehicle, side airbags must deploy very quickly to cushion occupants from intruding vehicles or objects. Side airbags typically deploy within the first 10-20 milliseconds of a side crash. Several auto manufacturers deploy the side airbags in frontal crashes to help control occupant movement during the rebound phase of a crash. Curtain side airbags generally stay inflated longer to protect occupants in rollover crashes. In addition to protecting the head and chest from impact, allowing the airbags to remain inflated and triggering their deployment during a rollover helps prevent full or partial ejection of occupants.

Side airbags are not required by the government. However, in September 2007, the National Highway Traffic Safety Administration (NHTSA) issued new side-impact safety requirements that likely will result in more manufacturers equipping their vehicles with side airbags. The new standard requires automakers to provide increased head and torso protection for front seat and rear seat occupants in side-impact crashes but doesn't mandate side airbags specifically. This standard went into effect late last year and the auto manufacturers have four years to comply.

According to the Insurance Institute for Highway Safety website, eighty-eight percent of all 2009 passenger vehicle models offer side airbags (75 percent as standard equipment, 13 percent as optional equipment). Of 2009 model year vehicles, side airbags were provided as standard or optional equipment in 95 percent of cars, 100 percent of SUVs, and 66 percent of pickups.

Side airbags come in different configurations, although as explained below, most manufacturers now favor curtain style airbags, which are effective in rollovers. Photo 1 is an example of a seat mounted head/torso side airbag. Photos 2 and 3 are seat mounted torso with drop down curtain style side airbags. Photo 4 is a convertible seat and door mounted side airbag. Photo 5 is a Honda curtain airbag. Photo 6 is a Volvo curtain airbag.

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3.



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6.



Insurance Institute for Highway Safety analysis of the efficacy of side airbags with head protection showed a 37 percent reduction in a car driver's risk of death in driver-side crashes. The fatality risk was reduced by 26 percent when the side airbag was designed to protect only the torso. The fatality risk for SUV drivers was reduced by 52 percent with head-protecting side airbags and by 30 percent with torso-only airbags. [McCartt, A.T. and Kyrychenko S.Y. (2007). Efficacy of side airbags in reducing driver deaths in driver-side car and SUV collisions. *Traffic Injury Prevention* 8:162-70.]

### **The Development of Ford's Safety Canopy System**

What eventually became known as the Safety Canopy involves the use of seatbelt pretensioners, side airbag curtains, cold gas airbag inflaters and rollover sensors. In the event of rollover, pretensioners are activated, retracting and locking the seatbelt to reduce occupant movement, and the front and side airbags are deployed to prevent movement, cushion impact and prevent ejection. The cold gas inflaters allow the bags to remain inflated for up to six (6) seconds. This allows the bags to continue to remain inflated throughout most rollover events.

In addition to cushioning the occupants from intrusions in side impacts and from contact with the vehicle interior in rollovers, one of the intended design benefits of a side airbag curtain was to reduce total and partial ejection through the side window. The idea was to combine a large side airbag covering the window (a "curtain") with a roll sensor. Using longer inflation to compensate for the greater duration in time of a typical rollover crash as compared to front or side impacts, the curtain would provide a barrier preventing total and partial ejection. This, coupled with the use of seatbelt pretensioners, would substantially reduce or, in many cases, eliminate the likelihood of total or partial ejection, the leading cause of fatalities in rollovers.

Ford's interest in what eventually became the Safety Canopy system started in the 90s. By the mid-90s Ford had detected a strong link between the higher risk of injury in light truck and SUV rollovers and the need to mitigate injuries and ejections through automotive design countermeasures. Light trucks were twice as likely to rollover as passenger cars and that rate was rising. The percentage of fatal SUV rollovers – 37 percent – exceeded the light truck average of 25 percent. The serious injuries were most often caused by contact with interior features such as roofs, pillars, rails and headers—and through ejection. (Occupants of light trucks were twice as likely to be ejected and ejection accounted for 27 percent of fatalities in passenger car rollovers.)

Following Volvo's introduction of an Autoliv torso-only protection side airbag in 1994 (1995 model year) there was a rapid move to develop side-curtain airbags and side airbag protection against head impacts as well as adding roll activated side curtains. ("Volvo's Side Airbag Sets Makers Scrambling" (Automotive News, 7/25/94); 68 Annual Report 1994, Autoliv; 69 Annual Report 1995, Autoliv.)

By 1996 there was a heated race to be the first to install side curtain airbags. (Side-Impact Curtains in 1997 (Automotive News Europe, 08/05/96); "Autoliv Takes on the World," (Automotive News Europe, 02/05/96).) Ultimately, Mercedes won when it introduced the systems in 1998, only months before Volvo. Just prior to the introduction of the side curtain, BMW was the first to address head protection in a 1997 model with its Inflatable Tubular Structure, a Simula / Autoliv design that deployed between the A and B-pillars to protect occupants' heads in a side crash. ("Curtain Protects in Side Impacts: Saab to Debut System in January" (Automotive News, 08/26/98); "Side Impact Airbags: Inflatable Curtain" (Autoliv, 1998).) Following on Mercedes and Volvo's heels, Audi and Toyota also

introduced side curtains in 1998 while Ford took a different route that committed it to head and torso bag combinations, which it began installing that year. According to Autoliv it developed the Inflatable Curtain with Mercedes and Volvo and the Head / Thorax bag with Ford and Renault. ("Japanese Shine with Low-Emission Cars" (Automotive News, 10/06/97); Annual Report 1998, Autoliv; Annual Report 1997, Autoliv.)

Ford planned to introduce side airbags offering head and torso protection in 1998 model year European market vehicles and some U.S. models the following year. ("Ford Plans Big Push in Side Bags: 1-Piece Device Protects Head and Chest" (Automotive News, 12/25/95).)

In early 1998, Ford made the decision to include roll sensor activated pretensioners (and side curtain airbags) on the 2002/ Explorer Sport Trac. By the time Ford made the decision to include roll-activated pretensioners, Volvo had already introduced its 1998 model year C70 convertible which incorporated the feature. (1998 Volvo Safety Brochure.) According to Volvo's brochure, the C70 incorporated four seat belt pretensioners activated "in certain types of accidents," including rollover. This appears to be the first production model with roll activated pretensioners. While this vehicle may have been the first automotive platform to combine pretensioners with roll sensors, it is apparent that both technologies were available prior to 1998.

The need for systems to decrease the risk of rollover injuries in light trucks and SUVs also spurred development of Ford's Electronic Stability Control (ESC) system in the 90s. The Ford system was marketed under the name AdvanceTrac and was referred to in house as the Interactive Vehicle Dynamic (IVD) system. Jean Borge has a good description of IVD as installed on the model year 2000 Ford Focus on the SAE website. In 2000, Ford engineers were discussing the concept of adding a roll sensor to the basic IVD yaw sensor and modifying the side airbag system to remain inflated for longer periods. This was viewed as an effective means to protect against ejection in rollovers.

However, Ford's production vehicles remained committed to the somewhat less expensive non-curtain side airbags. According to Ford's product materials, by model year 2000, side-impact airbags were optional on the Navigator (2000 Navigator Overview; Ford; 2000) and the Expedition (2000 Expedition Overview; Ford; 2000), which shared a platform with the F-150. In 2001, side-impact airbags were available on the Escape. (2001 Escape Safety; Ford; 2001.) These were not curtain airbags.

By 2000, Ford had set rollover prevention targets for light truck stability which included making future trucks as stable as current cars and future trucks safer in terms of occupant protection than current cars. The target for small trucks was the 2000 Focus, for large trucks, the 2000 Taurus. In connection with this effort, Ford compared occupant protection in rollovers as well as rollover rates between two of its most popular vehicles, the Taurus and the Explorer. Ford found that while occupant protection was about the same, the rates of injuries and deaths in rollovers were three times greater in the Explorer and concluded this was because of its higher rollover risk. Despite this in house conclusion, in the summer of 2000, Ford's CEO testified before Congress and attributed Explorer rollover fatalities not to higher rollover risk or lack of accident prevention, but to Firestone's tires.

As a result of the bad publicity, by late 2000, a rollover curtain and IVD for the Explorer Sport and Sport Trac were considered by marketers to be among customers most desired features. The marketers described these features as "necessary to survive in the market." The safety engineers, perhaps prescient, but more likely conscious of Ford's history, advised that IVD and Safety Canopy System implementation on Ford vehicles "should not be considered opportunities for revenue growth." Initially, the marketers agreed.

Through the spring and summer of 2001, the expectation among Ford's marketers was that the Safety Canopy would be among the safety features of the newly re-designed 2002 Explorer, standard in the 2003 MY Explorer and part of a standard package, including IVD and a tire pressure sensing monitor for the 2003 MY Expedition and Navigator. The marketers were convinced Ford had decided to go with the 100-percent inclusion as standard equipment strategy for the two high-end SUVs.

All of this was unfolding before the backdrop of escalating public awareness of Explorer rollovers, resultant catastrophic injuries and deaths, and the continuing Ford Explorer/Firestone public relations nightmare. According to testimony, the goal was to keep the Explorer's profitability high, balanced against public relations pressures to repair the Explorer's reputation as a safe SUV. Ultimately, Ford decided that the Explorer's safety record would survive government and public scrutiny. By July of 2001, the decision had been made to ignore the earlier advice of Ford's safety engineers and to try to make safety a profit point by offering the Safety Canopy and IVD as an option only. There was one caveat - if the safety press went negative, the Safety Canopy and IVD would be included as a standard feature.

Ford thus made the Safety Canopy an option for the United States Explorer in model year 2002 ½, with a plan to make it standard, only if necessary.

Once again, Ford's upper management overruled Ford's engineers. Management saw the Safety Canopy system as a potential profit point, made it a \$560 option, and the marketers were tasked with selling it. The Explorer Sport Trac was one of the first models to offer the option. Ford marketers appealed to the Explorer Sport Trac audience, arguing the customer should pay for the option.

"You don't like to think about safety, but you should. Sport Trac's available Safety Canopy System uses advanced sensors to deploy side curtain airbags in certain side-impact or rollover events. Each airbag covers approximately 2/3 of the side glass. It stays inflated for a longer duration to provide enhanced head and shoulder protection." ('03 Explorer Sport Trac No Boundaries; Brochure; Ford; 2003.)

### **The Safety Canopy System Stagers to Market**

Ford began promising the public the swift advent of the Safety Canopy as early as January 2000 and continued to do so in other venues. In a press release, Ford announced that "during the 2001 model year, Ford will offer optional new rollover sensors and inflatable side curtains on its SUVs." ("Ford to Offer SUV rollover protection package" Ford Media, 01/12/00; Safer Sport-Utes: Sport Utility to get \$30 Million Ad Blitz; Auto News 01/31/00.) An article in February 2000 Wards AutoWorld stated that "Ford Motor Co. will install new side airbag 'curtains' on its '01 Explorer and Mountaineer - at least surreptitiously addressing the long-held understanding that sport/utility vehicles (SUVs) are more prone to rollover-type accidents." ("Ford Notches Up SUV Safety Profile," Ward's Auto World, 2/1/00.) The article noted that the side curtains included "an advanced new roll sensor" and "new cold gas inflators that keep the bag fully inflated for six seconds." It also noted that these roll-activated curtains had been under development at Ford for 30 months and would be launched on Explorer/Mountaineer followed by the 2002 Expedition and Navigator.

The Safety Canopy didn't debut on an Explorer until the 2002 model year and well into the 2002 calendar year. When the re-designed version of the automaker's signature SUV went on sale on March 29, 2001, only side curtain airbags were available, but the 2002 brochure promised that rollover sensors would appear later in 2001. (2002 Explorer: A New Level of Safety; 2001.) By August 2001, the Safety

Canopy still had not made it onto a production vehicle, but Ford again promised, in a press release touting this new technology, that it was coming. (Safety Canopy and Other Technologies Provide Unprecedented Occupant Protection; Ford press release; August 21, 2001.) By December 11, 2001, Ford was again touting both innovations among the safety features of its 2002 Explorer in a press release. In that announcement, Ford said that the Safety Canopy would be available later in calendar year 2002. (Ford Explorer Overview: New for 2002, Ford Media, 2001.) However, in a December 2001 SAE publication, *Automotive Engineering*, Ford highlighted its Safety Canopy with cold gas inflation and falsely noted that the feature was already available on its 2002 Explorer and Mountaineer. (Ford Researching Safety For Things That Move; Kami Buchholz; *Automotive Engineering*; December 2001.)

But the Safety Canopy apparently was not actually available to consumers until mid-calendar year 2002. According to an article in *Automotive News*, Ford safety chief Sue Cischke said that the rollover package – including the Safety Canopy – would be available in April. (Ford delays rollover package until spring, *Auto News*, February 18, 2006.) In August 2002, TRW, which supplied the cold-gas inflator, announced that the part was on the “recently launched” Explorer and Mountaineer. (TRW Supplies Industry Leading Cold Gas Inflator and Safety Canopy for 2002 Ford Models; TRW; July 15, 2002.)

In the 2003 model year, the Safety Canopy was still optional on the Explorer. (All New for 2003: the 2003 Explorer; Ford; 2003.) The Safety Canopy became available on the model year 2003 Mountaineer and the Explorer Sport Trac (2003 Mountaineer Safety; Ford; 2003; 2003 Explorer Sport Trac Overview; Ford; 2003) (It became standard on its premier package in 2005) (2005 Mountaineer Overview; Ford; 2005); and standard on the Navigator. (2003 Navigator Overview; Ford; 2003.) By 2006, the Safety Canopy, as an option or as a standard feature had spread to include all of its SUVs and passenger vans: the Escape (2006 Escape Overview; Ford; 2006), the Freestyle (2006 Freestyle Overview; Ford; 2006), the Mariner (2006 Mariner Overview; Ford; 2006), The Mariner Hybrid (2006 Mariner Hybrid Overview; Ford; 2006), the Monterey (2006 Monterey Overview; Ford; 2006), the Freestar (2006 Freestar Overview; Ford; 2006), the Explorer (2006 Explorer Safety; Ford; 2006), the Expedition (2006 Expedition Overview; Ford; 2006) and the Navigator (2006 Navigator Overview; Ford; 2006).

Although Ford planned to debut the Safety Canopy on the Explorer, Ford's pick-ups were supposed to follow in quick succession. Optimism that the Safety Canopy could be applied to a low-cost truck at an appealing price, and Ford's safety strategy notwithstanding, Ford has not yet applied the Safety Canopy, optional or otherwise to the F-150 or the Ranger. To date, the only Ford pick-up with the Safety Canopy is the Explorer Sport Trac. Ford introduced the feature on the 2003 model year.

### **Ford Includes the Safety Canopy as Standard Equipment in Europe**

The 2002 ½ Explorer with the Safety Canopy was manufactured in the United States. As noted above, in order to increase revenue, the Safety Canopy was offered as an option for \$560 in the United States. However, the European Union version of the same Explorer included the Safety Canopy as standard equipment. The Safety Canopy was included as standard equipment in other countries as well. The Explorers sold with the Safety Canopy as standard equipment were manufactured in the United States, at the same Ford plant that manufactured the Explorers sold in the United States with the Safety Canopy as an option.. According to Edmonds.com the actual increased parts cost to the manufacturer of the system was about \$33 per vehicle. The increased Ford revenue generated by making the Safety Canopy an option in the United States was estimated to be as high as \$40 million.

## Conclusion

Most would view Ford's decision to ignore its' safety engineers and offer the Safety Canopy only as an option as reprehensible. Certainly those who have been catastrophically injured and the families of those killed would agree. The second prong of the *Barker v. Lull Engineering Co.* (1978) 20 Cal.3d 413, 430 [143 Cal.Rptr. 225] defective design test, whether "the risk of danger inherent in the challenged design outweighs the benefits of such design" applies here. One of the criteria a trier of fact is to look when weighing risk and danger is "the financial cost of an improved design". *Barker, supra*, at 431. The low cost of the improvement coupled with the expected and then proven benefits on the rollover protection system, would seem to be strong evidence that Ford should be held liable for design defect in these cases.

As far as this author can determine, there is no California authority for the proposition that a manufacturer can escape liability by offering the safety improvement as an expensive option. The earlier California authorities indicate such a defense is not available. For example, a manufacturer was not allowed to avoid liability by arguing that it offered a retrofit or that the vehicle owner ignored a recall.

There is another problem on the horizon for cases based upon such conduct.

In other jurisdictions, Ford has begun arguing that such claims are pre-empted. Ford asserts the auto manufacturers all agreed with NHTSA to voluntarily provide side airbags in the face of threats to modify Motor Vehicle Safety Standards. From this, Ford argues that their should be implied preemption of all cases involving claims that side airbags or curtains should have been included in a vehicle's design. Given the makeup of the United States Supreme Court, expect Ford or some other manufacturer to attempt to take any successful prosecution to the ultimate judicial venue.

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