

SAFETY SELLS: Market Forces and Regulation in the Development of Airbags

By Martin Albaum

CHAPTER 6: The Consequences of the Airbag Rule: 1989-2002

From 1989 to 2000 the consequences of the automatic occupant protection rule developed in an environment characterized by a fairly stable or increasingly prosperous economy, conservative policies in spite of changes in political leadership, and continued concern about automobile safety mixed with hostility to government regulation. The gross domestic product grew 2 to 4 percentage points, in real terms, in most years. The exceptions were a real growth rate closer to 1 percent in 1990, a 1 percent decline in 1991, and 5 percent growth in 2000. The short recession of 1991 also brought with it a decline in retail vehicle sales. Apart from that recession, automobile manufacturers, on the whole, seemed reasonably sound financially. Domestic automakers benefited particularly from the growing market for utility vehicles, vans, and pickup trucks.

President George H. W. Bush's defeat by Bill Clinton in 1992 brought little change in the politics of automobile safety except for replacing the political leaders at the relevant agencies. The Republican domination of both houses of Congress in the 1994 elections had mixed results for highway safety rules. At the end of 1995, federal lawmakers gave speed limit regulation of interstate highways back to the states and ended incentive grants for helmet use laws. The same law initiated grants for states with laws allowing no measurable alcohol in people under 21. People killed in fatal highway crashes declined from 45,582 in 1989 to 39,250 in 1992, but then the number began to rise again, reaching an early estimate of 42,815 for 2002.

With the narrow presidential victory of George W. Bush in 2000 the executive branch became more strongly business oriented, but its drive toward deregulation did not aim at the airbag standards already in place. In the first year of the new Bush administration, economic growth came to a virtual halt, with real GDP growing 0.3 percent, improving to 2.4 percent in 2002. But sales of cars and light trucks declined 1.2 percent in 2001 and 1.7 percent in 2002.

Jeffrey W. Runge, an emergency room physician, became NHTSA administrator in August 2001. He continued the airbag and seat belt use programs of the Clinton administration and proposed to maintain its emphasis on encouraging state regulatory programs in his suggestions for renewing TEA 21.¹

1. Jeffrey W. Runge, Testimony Before the Subcommittee on Competition, Foreign Commerce, and Infrastructure Committee on Commerce, Science, and Transportation, United States Senate, May 22, 2003. Runge called the proposed program SAFETEA.

The Market Overtakes The Automatic Protection Rule

When the regulation requiring automatic occupant protection in cars finally came into force for the 1990 model year, it became a marketing opportunity. This occurred because of NHTSA's agreement to consider airbags for the driver only plus passive belts for right front passengers to be sufficient compliance with the passive restraint requirement for the time being. First the availability of driver airbags, and then their inclusion as standard equipment, became major selling points. General Motors and the Japanese manufacturers were at a disadvantage because of their late start — they had to cope not only with the design changes needed to install airbags but also with a shortage of facilities for manufacturing them.

The news media featured traffic crash stories with a new angle — lives saved by airbags. The high point of this publicity was occasioned by the head-on collision of two airbag-equipped Chrysler LeBarons in Culpeper, Virginia, on March 12, 1990. Both drivers — the only occupants — walked away from the collision. Only one had been belted. IIHS documented the crash in detail and acquired the cars. Chrysler boasted about it in a massive television campaign. Helen Petruskas of Ford believed the media stories about airbags in collisions, rather than any specific marketing move by any company, led to the massive demand for cars with airbags.² The reports often featured testimonials by the survivors that they were alive thanks to airbags. These stories spread quickly.

In model year 1989 more than 500,000 new passenger cars were sold with driver airbags. By 1990 more than 2.3 million cars, 27 percent of all new cars, had driver airbags but only 149,000 also had passenger airbags.³ In April 1990 the Insurance Institute for Highway Safety polled new car dealers in the Washington, D.C., area on customer attitudes toward safety. Two-thirds of dealers said that it appeared to be an important consideration, and more than half said that airbags were the safety feature most important to customers.⁴ A national survey sponsored by the insurance industry reported late in 1990 that the public was likely to consider “the degree to which a car protects people from injury in crashes” the most important factor in choosing a new car to buy. Two-thirds had seen or heard an ad about airbags in the past few months and half of these wanted a car with an airbag, although only 2 percent had one.⁵ A smaller national survey of prospective new car buyers, done for the Insurance Institute for Highway Safety in March 1992, found that 67 percent said driver airbags were very important safety features and 54 percent said passenger airbags were very important.⁶ While belts had been the method chosen overwhelmingly by manufacturers to meet the automatic occupant protection requirements during the phase-in period, in 1990-1993 airbags took over and then became dominant. By the 1994 model year they

2. Interview with Helen Petruskas, May 4, 1996.

3. Department of Transportation, National Highway Traffic Safety Administration, Office of Plans and Policy, “Unpublished estimates of airbag installations in the in-use fleet,” nd.

4. *Status Report*, June 30, 1990, pp. 1,6.

5. *Public Attitude Monitor 1990: A Survey of Public Attitudes on Auto Safety Issues*, Insurance Research Council, December 1990.

6. Susan Ferguson, ‘Survey of New Car Buyers, Insurance Institute for Highway Safety,’ July 1992.

were in 91 percent of all passenger car models, with 63 percent having dual airbags. *The Wall Street Journal* reported that General Motors was at a competitive disadvantage in the 1994 model year because 44 percent of its car lines did not have dual airbags, compared with 25 percent for Ford and Chrysler. By then Honda was offering dual airbags in all its U.S. cars.⁷ In almost all cases the airbags were standard equipment. In 1995 almost all new cars were equipped with airbags, and 90 percent had dual airbags. In the same year 85 percent of new light trucks had driver airbags and 18 percent had them on the passenger side.⁸ By the middle of 1995, however, only 27 percent of passenger vehicles on the road (both cars and light trucks) had airbags on the driver and only 7 percent had them on the passenger side.⁹

About 1990-1991, European car and consumer magazines began to spread the word that airbags could save lives, even among those who invariably wore seat belts. Although Mercedes, BMW, and Volvo had made airbags available for the driver for some time in Europe, they were not in lower-priced cars and drew little notice. Europeans were not attracted by the concept of “passive restraint.” In places like Germany, Britain, Scandinavia, Belgium, and the Netherlands, belt use laws were widely observed. But articles like one in *Automotor und Sport* in 1991 that compared crash tests of Mercedes with and without driver airbags stimulated interest. By 1993, airbags had also become an important competitive tool among European manufacturers, especially in Germany, Britain, and other northern countries. There was little interest in Italy, Spain, or much of France. By 1995, it was expected that 40-50 percent of new cars in Europe would have driver airbags and about 25 percent would have passenger airbags. All of this was happening without the benefit of government regulation. Nor is there currently any such regulation in Europe or anyplace else outside the United States. Australia requires that if airbags are installed, they conform to requirements derived from FMVSS 208 but only as applied to belted drivers.¹⁰

European driver airbags were often much smaller (30-50 percent smaller) than those in American cars, although Mercedes, Opel, Saab, Volvo, and Jaguar did use full-size bags. There is no published evaluation, based on statistically significant data, of the effectiveness of airbags in Europe. A theoretical analysis suggests that the smaller European bags, dubbed ‘facebags,’ are less beneficial than full-size airbags.¹¹ However, reviews of small samples of crashes involving airbags in Europe consistently reported that they were associated with lower severity injuries, fewer head injuries, and none of the serious

7. “Automobiles,” *Wall Street Journal*, October 12, 1993.

8. *Status Report*, October 9, 1993, p. 10; see also, note 1. An academic study also documents the role of buyer demand in the spread of airbags: Fred Manning and Clifford Winston, “Automobile Airbags in the 1990’s: Market Failure or Market Efficiency,” *Journal of Law and Economics*, vol. XXXVIII, October 1995, pp. 265-279.

9. Memorandum by Becky Trempel, “Estimated Number of Vehicles in Fleet with Airbags,” Highway Loss Data Institute, February 1998.

10. National Transportation Safety Board. *Proceedings of the National Transportation Safety Board Public Forum on Airbags and Child Passenger Safety*; 1997 March 17-20; Washington, DC. Report of Proceedings NTSB/RP-97/01. Washington, DC., 1997, pp. 328-330. A British government advisory on the internet dated 6/1/01 noted that most new cars have a frontal airbag for the driver, and many do for the passenger, but there is no regulation requiring them. <http://www.roads.dtlr.gov.uk/vehicle/standards/airbags/index.htm>.

11. B.N. Fildes, et. al., “Airbag and Facebag Benefits and Costs,” *Accident Analysis and Prevention*, vol. 26, No. 3, pp. 339-346.

problems occasioned by airbags in the United States.¹² An Australian study showed that belted drivers experienced significant reduction in the frequency of moderate to severe injuries to the head and chest and in the frequency of all injuries to the neck, although injuries to the upper extremities increased. “Societal harm” per driver was 60 percent greater in vehicles without airbags.¹³

The marketing appeal of airbags may have contributed to Volvo’s decision to use them to protect drivers and right-front passengers from side impacts. Earlier, in 1994, GM said it was studying side airbags. They were made available first in Volvo’s luxury 850 model for 1995 and later in all its models. Side airbags were much smaller than frontal ones and were designed initially to protect the thorax; protection for the head came later. By the spring of 1996 virtually every major airbag supplier was developing side airbags for auto companies. Mercedes had begun offering them in some 1996 models, and Audi, BMW, and Toyota announced plans for some 1997 models. GM said side airbags would be standard in Cadillac DeVilles and the new Catera in 1997.¹⁴ In April 1998 Ford announced that side airbags would be available in all of its passenger cars during the next few years, including the Windstar minivan. They became standard equipment in Cadillac Seville and Chevrolet Prism sedans and in Chevrolet Venture, Oldsmobile Silhouette, and Pontiac Trans Sport minivans, as well as in all BMWs. Side airbags were options on Mercedes models and on the Toyota Camry and Corolla.¹⁵ All of this took place in the absence of any regulatory requirement. In fact the design of side airbags might have conflicted with federal head protection requirements, although BMW’s version of side airbags had been shown by IIHS tests to be effective protection for the head. But NHTSA issued a rule eliminating any conflict just before the start of the 1999 model year.¹⁶

More Regulations: A Performance Standard Replaced by a Technological Standard

During the mid-to-late 1980s light trucks became a well-established part of the American passenger motor vehicle market. Vans, pickups, and utility vehicles make up this category, as defined by NHTSA. While not included in passenger car sales statistics kept by manufacturers, they accounted for about 5 million sales annually between 1985 and 1988 compared with about 10 million passenger cars per year. Light trucks were not covered by the 1984 automatic protection requirements although, by the 1992 model year, they had to meet injury reduction criteria in a 30 mph barrier crash either with manual three-

12. D. Otte, “Review of the Airbag Effectiveness in Real Life Accident Demands for Positioning and Optimal Deployment of Airbag Systems,” *39th Stapp Car Crash Conference Proceedings*, P-299, November 1995, pp. 1-10; Langwieder, K., Hummel, T.A., Muller, C.B., “Experience with Airbag-Equipped Cars in Real-Life Accidents in Germany,” *Proceedings, The Fifteenth Technical Conference on Enhanced Safety of Vehicles*, Melbourne Australia, May 13-16, 1996, pp. 132-154, cited in James Lenard, Richard Frampton, Pete Thomas, “The Influence of European Airbags on Crash Injury Outcomes,” Paper No. 98-S5-0-01, for delivery at the 16th ESV Conference, 1998. See also the last note.

13. Morris A, Barnes J, Fildes B, Bentivegna F and Seyer K, “Effectiveness of ADR 69: A Case-Control Study of Crashed Vehicles Equipped with Airbags,” *Road Safety Research Report*, CR 199, May 2001.

14. *Status Report*, May 4, 1996, pp. 1-3, 6.

15. *New York Times*, April 8, 1998, p. A 1.

16. *Status Report*, December 27, 1997, pp. 1-5; Department of Transportation Press Release, July 30, 1998.

point belts or automatic crash protection. Fatalities in these vehicles went from 6,500 in 1984 to 8,300 in 1988; NHTSA estimated that the death rate per occupant was roughly equal to that for passenger cars. The agency found that manual lap/shoulder belts were even more effective in reducing fatalities in pickups than in passenger cars, but were used less frequently. Thus the potential for saving lives and injuries by applying automatic crash protection requirements to these vehicles seemed particularly high.

After noting that mandatory use laws had not passed in enough states to prevent the automatic crash protection rule from taking effect for all new cars, NHTSA waited close to a year before proposing comparable automatic protection for light trucks. The proposal was analogous to the passenger car rule, including driver airbag credits. Each manufacturer and importer would be required to have automatic protection in 20 percent of its 1994 model-year light trucks, 50 percent of 1995 models, and all 1996 models. The schedule was more aggressive than for passenger cars, but the agency felt that most of the structural changes needed would have already been made to meet the dynamic test criteria for manual belts. Driver airbags would get a one-truck credit over a four-year period from the start of the phase-in. That is, requirements for automatic protection for the passenger would be delayed through the 1998 model year for trucks equipped with driver airbags. The justification for this was much the same as it was for cars. The agency still thought that manufacturers would choose to provide the easily installed automatic belts rather than a driver airbag and an automatic belt. In another similarity to the car rule, the proposal allowed automatic belts to be detachable, although NHTSA had recently granted IIHS' petition to amend FMVSS 208 to prohibit detachable belts. Because many pickups had no rear seats, the proposal included provision of attachments for child seats at the right front passenger position.¹⁷

More than a year passed before the agency issued a final rule. By this time Chrysler had already announced that driver airbags would be available in many of its vans and minivans, and Ford said they would be standard in one 1992 minivan model and two full-size vans.¹⁸ NHTSA added campers, motor homes, and convertible open-body trucks to the light trucks covered by the new rule. The design problems posed by convertible and open-body light trucks were part of the justification for extending the end of the phase-in schedule. The beginning of the phase-in was also delayed because of the fairly unanimous concern of manufacturers about the pressure of making multiple changes for the 1994 model year. These included the end of the driver airbag credit for cars as well as the extension of other passenger car standards to light trucks. The increased demand for airbag sensors for passenger airbags would make them less available for light trucks. So the new schedule required automatic protection in 20 percent of light trucks produced in the 1995 model year, 50 percent in 1996, 90 percent in 1997, and 100 percent by

17. Department of Transportation, National Highway Traffic Safety Administration, [Docket No. 74-14; Notice 62] Federal Motor Vehicle Safety Standard: Occupant Crash Protection. Notice of Proposed Rulemaking. Federal Register, January 9, 1990, pp.747-760. The IIHS petition of February 28, 1989, to prohibit the use of detachable automatic belts, was granted in a letter from Barry Felrice, Associate Administrator for Rulemaking, on August 4, 1989. It was apparently never implemented..

18. *Status Report*, January 25, 1991, p. 2.

the 1998 model year. If it had only one model of light truck, a manufacturer could delay introducing automatic protection during the first phase-in year, but would then have to meet the rule for all its light trucks in the second year. The four-year duration for the “one-truck” credit for driver airbags was retained. Automatic belts could still be detachable.¹⁹

Before NHTSA could issue its final rule, four senators introduced a bill that preempted it. The bill required airbags to be installed not only for drivers and right-front passengers in all cars manufactured after September 1, 1995, but also for all drivers of vans, pickups, and utility vehicles after September 1, 1996. The next year, passenger airbags would be mandated for light trucks. Senator Richard Bryan (D-NV) was the chief sponsor, with Senators John Danforth (R-MO), Brock Adams (D-WA), and Slade Gorton (R-WA) as cosponsors. They based their proposal on their belief that airbags were clearly superior to automatic belts, especially the detachable kind. There was little debate about the bill. In subcommittee hearings, the noncongressional proponents were represented mainly by Joan Claybrook of Public Citizen and Ben Kelley, then with the Institute for Injury Reduction. The insurance industry and IIHS did not take a stand on the bill. The Motor Vehicle Manufacturers Association did object, not to the intent of the bill, but to mandating a technology rather than a performance standard. The manufacturers also wanted some easing of the timetable, which they got in the final law. NHTSA Administrator Jerry Ralph Curry shared some of the manufacturers’ concerns, but, speaking for the Bush Administration, he did not oppose the law.²⁰

The law became part of the Intermodal Surface Transportation Efficiency Act (ISTEA), signed by President Bush on December 18, 1991. Dual airbags plus manual lap/shoulder belts were to be installed in at least 95 percent of passenger cars manufactured in the 1995 model year and in all cars thereafter. During the 1998 model year 80 percent of light trucks would be required to have at least a driver airbag (as NHTSA interpreted the law), and in the 1999 model year all light trucks would have to have airbags and manual belts for both front outboard seats. So the performance standard for automatic protection was finally replaced by a law mandating airbags.²¹

The Growth of Seat Belt Use

While driver airbags were becoming increasingly common on American roads, drivers were also using their seat belts more often. Belt use rates went from 14 percent when the Dole decision was issued to 51 percent in 1991 (see the table below). There is no objective analysis available to explain the rise of seat belt use in the United States. But it seems reasonable to assume that increased usage was due both to the influence of state seat belt use laws and the spread of automatic seat belts. While there had been some

19. NHTSA (DOT), [Docket No. 74-14; Notice 70] Federal Motor Vehicle Safety Standards; Automatic Crash Protection, Final Rule, *Federal Register*, March 26, 1991, pp. 12472-12487.

20. *Status Report*, March 19, 1991, p. 2 and May 4, 1991, p. 9.

21. *Status Report*, December 31, 1991, p. 1; NHTSA (DOT) [Docket No. 74-14; Notice 79] Federal Motor Vehicle Safety Standard; Occupant Crash Protection, Notice of Proposed Rulemaking, *Federal Register*, December 14, 1992, pp. 59043-59053. The NPRM proposed the regulations required by the 1991 act.

speculation that airbag protection would make people less likely to use seat belts, a 1990 study by the Insurance Institute for Highway Safety proved otherwise. A survey observing belt use among drivers of late model cars in four metropolitan areas showed that drivers of cars with airbags were just as likely to use their seat belts as drivers of cars without airbags.²²

Driver belt use in 19 cities ²³	
1983	14 percent
1984	14 percent
1985	21 percent
1986	30 percent
1987	42 percent
1988	46 percent
1989	46 percent
1990	49 percent
1991	51 percent

Automatic belts contributed to belt usage, but the contribution was greater if the belts were motorized than if they were not, and also greater if they were not detachable. Other data from NHTSA's 19-city seat belt use study showed that in 1987 there was 99 percent belt use among drivers of cars with motorized belts with no disconnect, 95 percent among those with a disconnect, 77 percent for nonmotorized 3-point belts, and 83 percent for nonmotorized 2-point belts. By 1991 there was a deterioration in all categories, although it was less for motorized belts overall and for those without disconnects than for the other belt types.²⁴

NHTSA stopped its 19-city seat belt use surveys after 1991 and began to rely on weighted summaries of state belt-use surveys. After making appropriate adjustments for differences in state methodologies, NHTSA reported that overall "belt use increased steadily in the United States, from 54.1 percent in 1991 to 69.5 percent in 1999. Belt use in cars increased from 59.1 percent to 72.4 percent; in light trucks, from 45.1 percent to 65.8 percent."²⁵

The best available estimate of national seat belt use is from NHTSA's National Occupant Protection Use Survey (NOPUS), a probability sample of observed shoulder belt use conducted for the first time late in 1994. It produced an overall estimate of 58 percent for seat belt use in all vehicles, 63 percent in passenger cars.²⁶ NOPUS was repeated in the last quarter of 1996, reporting an overall estimate

22. *Status Report*, June 30, 1990, p. 3. The full report is in: Allan F. Williams, JoAnn K. Wells and Adrian K. Lund, "Seat Belt Use in Cars with Airbags," *American Journal of Public Health*, December 1990, vol 80, pp. 1514-1516. A statewide survey in North Carolina produced comparable results. D.W. Reinfurt, C.L. St-Cyr, W.W. Hunter, "Usage patterns and misuse rates of automatic seat belts by system type," *Accident Analysis and Prevention*, 1991, pp. 521-530.

23. DOT, NHTSA, *Evaluation of the Effectiveness of Occupant Protection: Federal Motor Vehicle Safety Standard 208*, Interim Report, June 1992, [DOT-HS-807 843] p. 12.

24. *Ibid.*, p. 13.

25. Charles J. Kahane, *Fatality Reduction by Safety Belts for Front-Seat Occupants of Cars and Light Trucks; Updated and Expanded Estimates Based on 1986-99 FARS Data*, Evaluation Division, Plans and Policy, National Highway Traffic Safety Administration, December 2000, [DOT HS 809 199], p. 63.

26. National Highway Traffic Safety Administration, *Third Report to Congress*, pp. 56-65. The state based use figure for 1995 is also taken from this report. The report also comments on some of the shortcomings of the state surveys.

of 61 percent belt use in all passenger vehicles, 64 percent in cars.²⁷ The measurement of NOPUS in the fall of 2000 showed 71 percent belt use in all passenger vehicles, 74 percent for cars.²⁸ These rates would have seemed utopian in 1984, when the final rule for automatic occupant protection was issued and driver belt use was 14 percent. But in October 1994 Transport Canada reported driver belt use in that country had reached 92 percent.²⁹ This increase was not due to automatic belts but to enhanced enforcement.

Evaluating Driver Airbags

By the middle of 1991 there had been enough deployments of driver airbags to permit analyses of their effectiveness based on actual crash experience. The first studies were published in October 1991 by the Insurance Institute for Highway Safety and its affiliate, the Highway Loss Data Institute.

The HLDI study used the only set of data available at the time that would allow analysis of significant samples of injuries rather than fatalities. It was based on a special survey of collision claims in the HLDI data base, involving frontal impacts exceeding \$5,000 for 1990 model-year cars during April-December 1990 in the files of 11 insurers. Thirty percent of the claims were for cars equipped with airbags, 70 percent for those with automatic belts. The airbag cars were more likely to have longer wheel bases and to be more expensive. The key results were:

When the data were standardized to account for differences in car size, drivers of airbag and automatic belt cars had the same frequency of injury, regardless of severity. However, moderate and severe injury rates were 28 percent lower and hospital injury rates were 24 percent lower for drivers of airbag cars than for drivers of automatic belt cars...

Drivers of airbag cars generally had lower rates of injury to the head and torso regions than did drivers of automatic belt cars. These differences were more pronounced when only moderate and severe head and torso injuries were compared.

There were comparable differences between airbag and automatic belt cars when results were standardized to account for differences in car price.³⁰

The IIHS study was more definitive and dramatic since it was based on deaths reported in the federal Fatal Accident Reporting System (FARS) during 1985-1991 for cars in those model years. Driver deaths from collisions in cars with airbags were compared with deaths in cars with manual belts only, of the same make, series and size class. (Some airbag cars were included in the main analysis even though there was no earlier airbag car of that model.) The estimates were based on driver fatalities in frontal crashes compared with driver fatalities in nonfrontal crashes for airbag cars versus manual belt-only cars. This assumed that the airbag had no effect in nonfrontal crashes. Driver fatalities in *frontal* crashes were

27. NHTSA, Research Note: *Observed Belt Use in 1996*, April 1997.

28. *Observed Safety Belt Use Fall 2000* National Occupant Protection Use Survey, Research Note, February 2001, U.S. Department of Transportation, National Highway Traffic Safety Administration.

29. *Status Report*, July 1, 1995, P. 2.

30. *Driver Injury Experience in 1990 Models Equipped with Airbags or Automatic Belts*, Highway Loss Data Institute, Insurance Special Report A-38, October 1991.

28 percent lower in airbag cars and 19 percent lower in *all* crashes. Frontal fatalities were reduced 50 percent in large cars, 19 percent in midsize cars, and 14 percent in small cars. Drivers reported to be belted in an airbag car (not always a reliable report) had 15 percent fewer deaths in frontal crashes than belted drivers without airbags, 31 percent fewer than unbelted drivers. The contribution of airbags to reducing fatality risk was, as expected, greater when the driver was otherwise unrestrained than when a seat belt was used.³¹

In June 1992 NHTSA published its first estimate of driver airbag effectiveness in its *Evaluation of the Effectiveness of Occupant Protection: Interim Report*, using FARS data. The report compared estimates of fatality reductions obtained using various restraint combinations with manual belt-equipped cars at 1983 use rates. (1983 was the year before the automatic crash protection rule was issued.) The results were:

Best Estimates: Fatality Reduction (Percent) Relative to Manual Belts at 1983 Use Rates³²	
Driver airbags with manual belts	23
Motorized 2-point belts (<i>without</i> disconnect)	16
Motorized 2-point belts (<i>with</i> disconnect)	7*
Motorized 3-point belts (<i>with</i> disconnect)	10
Nonmotorized 2-point belts	8*

*not statistically significant

What is not noted in the table is that the 1991 rate of manual belt use added another 10 percentage points to the 1983 fatality reduction rate attributed to manual belts. So only airbags and motorized 2-point belts without disconnect improved on the fatality gain realized from the then current use of manual belts. All of these estimates were averages — of five separate estimates in the case of airbags, and six estimates for each type of automatic belt. Adrian Lund of IIHS criticized the averaging techniques used for airbags; they combined estimates that were not equally valid. One estimate was based on a comparison of driver and passenger fatalities, which reduced the sample size by about two-thirds since passengers were frequently not present. Also crashes might differ depending on whether passengers were present. In other comparisons, “cars with belts only” were restricted to those cars weighing at least 2,500 pounds, while some airbag-equipped cars were lighter. Lund said that the best estimate was one that adjusted for the car’s mass, market class, age, manufacturer, driver age and sex, and calendar year. This produced a 17 percent fatality reduction estimate at 1991 manual belt use rates and a 26 percent fatality reduction compared with 1983 belt use rates.³³

31. Paul L. Zador and Michael A. Ciccone, “Driver Fatalities in Frontal Impacts: Comparisons Between Cars with Airbags and Manual Belts,” Insurance Institute for Highway Safety, October 1991.

32. *Op. cit.*, p. 35.

33. Adrian Lund, IIHS, Letter to Marion Blakey, Administrator, NHTSA, August 24, 1992. The regression is described in the Interim Report, p. 25.

In 1992 IIHS began several annual updates of driver airbag effectiveness, using the same procedures as it had in 1991. The results were almost the same: 29 percent reduction in fatalities in frontal crashes and 20 percent in all crashes for cars with airbags compared with manual belt-equipped cars at the current belt use rate. Airbag effectiveness continued to be higher for larger cars and for drivers reported to be unbelted.³⁴

In 1993 IIHS found 24 percent fewer deaths among drivers in airbag-equipped cars compared with other cars in frontal crashes from 1985-1992, which translated to a 16 percent fatality reduction in all kinds of crashes. Fatality reductions by car size and belt usage were somewhat lower. The growing data base of airbag crashes then allowed IIHS to begin comparing driver deaths in airbag cars with death rates in previous models without airbags, avoiding the assumption that there was no airbag effect in nonfrontal crashes. The nonairbag group was weighted to produce the same mix as for airbag cars. The result was also a 16 percent reduction related to airbags for fatalities in all kinds of crashes; frontal crash fatalities were reduced by 23 percent. IIHS president Brian O'Neill noted that airbag effectiveness estimates would change, presumably drop, as belt use inched up.³⁵

The survivors of crashes in which airbags deployed were enthusiastic witnesses for their effectiveness. But there were beginning to be some exceptions. IIHS sponsored a survey of the survivors of all 215 such crashes in North Carolina in 1991. Eighty-nine percent said that the airbags protected them, 76 percent said "a lot." Only four respondents did not want an airbag in their next car; they had gotten minor bruises, blisters or abrasions.³⁶

Early in 1994 State Farm researchers published a study of airbag effectiveness in terms of injuries, the first since the HLDI study of October 1991.³⁷ The principal source of the study was claims files involving airbag deployments since May 1989. As the largest auto insurer, State Farm collected data on 2,818 deployments — 27 for every 100 million miles traveled and 95 per 1,000 frontal crashes. Cars with collisions involving at least \$5,000 damage in which airbags deployed were somewhat more likely to have drivers with some injuries than comparable cars with belts only. But drivers in the airbag cars were 35 percent less likely to suffer moderate or severe injuries. Seat belts were still important. Belted drivers in cars where airbags deployed were 23 percent less likely to get moderate or severe injuries than unbelted drivers in deployments. Drivers in airbag deployments were more likely to have abrasions, lacerations, and contusions of the face, arms, and wrists but less likely to have potentially serious head and chest injuries.

34. *Status Report*, October 3, 1992, pp. 1-3.

35. *Status Report*, October 3, 1993, pp. 1-2. The same analysis was reported in more detail in Adrian K. Lund, Susan A. Ferguson, "Driver Fatalities in 1985-93 Cars with Airbags," Insurance Institute for Highway Safety, August 1994.

36. D.W. Reinfurt, et. al., "Survey of Attitudes of Drivers in Airbag Deployment Crashes," *Journal of Safety Research*, Vol. 23, No. 3, pp. 147-157.

37. John V. Werner and Wayne W. Sorenson, "Survey of Airbag Involved Accidents: An Analysis of Collision Characteristics, System Effectiveness and Injuries," Reprinted from *Safety Technology*, (SP-1041), SAE Technical Paper Series 940802, International Congress and Exposition, February 28-March 3, 1994.

About the same time as State Farm published its results, NHTSA updated fatality reduction estimates attributed to automatic occupant protection standards, with data from 1986 through mid-1993.³⁸ This time two methods were used to estimate driver airbag effectiveness. In the first, driver fatalities were compared with passenger fatalities to produce estimates of 15 percent fewer fatalities for cars with driver airbags versus those with manual belts only in frontal crashes, or 8 percent in all crashes. The second estimate used the IIHS method of comparing frontal crashes to all crashes (but eliminated models that got antilock braking systems at the same time as airbags). This produced estimates of an 18 percent fatality reduction in cars with driver airbags in frontal crashes, and 12 percent for all crashes. These estimates were based on comparisons with the current rate of manual belt use, which reduced fatalities 14 percent compared with the lower 1983 use rate. Averaging the two estimates of overall airbag effectiveness and comparing them with the 1983 manual belt use rate, NHTSA estimated that driver airbags had reduced fatalities 23 percent. But the only automatic belt system that saved more lives than did increased usage of manual belts — 5 percentage points more — was the motorized 2-point system without disconnect.

IIHS continued to get somewhat higher estimates of airbag effectiveness for driver fatalities than NHTSA did.³⁹ Another analysis sponsored by NHTSA showed that for calendar years 1991-1994, airbags plus safety belts were significantly more effective than safety belts alone, while airbags alone were still effective. Airbag deployments in tow-away crashes had risen to about 20 percent in 1994, and about 90 percent of these involved belt use, according to the analysis.⁴⁰

Although the various analyses differed in details and methods, all studies found that airbags were saving drivers' lives and reducing their rates of moderate and serious injuries. But State Farm did report that for claims over \$5,000 there was a higher incidence of *all* injuries in cars with airbags than in cars without airbags.

Injuries and Deaths from Airbags

Along with the enthusiastic press reports of people walking away from serious car crashes after airbags deployed, the media began, in the early 1990s, to report injuries and even deaths associated with airbag deployments, often in low-speed collisions. Lacerations or bruises of drivers' wrists and arms, eye injuries, and burns from the venting of hot airbag gases, were featured in the reports. One of the most balanced press accounts was published by *The Detroit Free Press* in November 1992. It concluded, "Airbags work. They've saved hundreds of lives, and trigger properly over 99 percent of the time." But

38. Charles J. Kahane, "Fatality Reduction by Automatic Occupant Protection in the United States," Presented at Experimental Safety Vehicle Conference, 1994. NHTSA. Paper No. 94-S5-0-08.

39. Susan S. Ferguson, Adrian K. Lund, Michael A. Greene, "Driver Fatalities in 1985-1994 Airbag Cars," IIHS, April 1995. This time driver airbag cars were compared both with cars with manual belts only and those with three pointed door-mounted automatic belts with a disconnect.

40. A.C. Malliaris, et. al., "Airbag Performance and Injury Patterns," SAE 960659, *Occupant Protection Technologies for Frontal Impact: Current Needs and Expectations for the 21st Century*, SP-1144. Society For Automotive Engineers, Warrendale, Ohio, 1996, pp. 49-72.

the article also noted that, “One-third of the motorists involved in airbag deployments are hurt by the bag. Most injuries are minor scrapes, bruises or burns, but airbags also have been blamed for some broken bones — and even a few deaths”⁴¹ The newspaper quoted Dr. Donald Huelke of the University of Michigan: “Some people get polio from the polio vaccine. Does that mean you drop the vaccine? Of course not. If any one is going to be seriously injured from an airbag, it’s a long shot.” About the same time Huelke and colleagues published an article in *The Journal of Trauma* that seemed to authoritatively confirm the minor nature of airbag-caused injuries.⁴²

Earlier in 1992 the Motor Vehicle Manufacturers Association (MVMA) had petitioned NHTSA to require a warning label in cars that, among other things, would say that airbags “could impart serious or even fatal injury to an occupant who is in close proximity to the steering wheel.” IIHS opposed the petition, partly because being close to the steering wheel was a hazard in all kinds of crashes, and MVMA had not shown a safety need for the warning.⁴³

On October 10, 1993, IIHS headlined an article in *Status Report*, “Close Study of Injuries from Airbags Yields Concern, Not Alarm.” It quoted a NHTSA study of 1,200 crashes of airbag-equipped cars in which 280 occupants had received “confirmed” injuries caused by airbags. Ninety-six percent of the injuries were minor (AIS 1) and 4 percent were moderate (AIS 2). Almost all the injuries were abrasions, bruises, cuts, or burns; 4 were fractures. Data from the National Accident Sampling System (NASS) for 1988-1991 showed that 45 percent of those in airbag crashes had minor injuries from their restraints compared with 11 percent of those restrained by belts only in crashes. The article also noted the occurrence of some more serious injuries. One, reported in the *New England Journal of Medicine*, had already been widely cited in the press. It involved an airbag-related tearing of the right atrium of the heart of a 22 year-old woman driver in a 10-15 mph crash, from which she eventually recovered.⁴⁴ IIHS also said there had been 5 or 6 driver fatalities, mostly involving women, sometimes elderly, sitting close to the steering wheel, or, in 2 cases, believed to be slumped over the wheel because of illness. There were also 2 deaths of children standing or sitting in front seats.⁴⁵ The same issue of *Status Report* (pp. 5-6) discussed how the characteristics of airbags — deployment speeds, folding patterns, tethering, sensors, and vents — might be changed to make airbags both more effective and safer. It looked forward to “smarter” airbags, whose inflation could be tailored to crash severity, belt use, and occupants’ proximity to airbags just before deployment. This anticipated much of the discussion of “smart airbags” that would appear in NHTSA documents.

41. *Detroit Free Press*, November 22, 1992, p. A 1.

42. Huelke, Donald F., Jamie L. Moore and Mats Ostrom, “Airbag Injuries and Occupant protection,” *The Journal of Trauma*, 1992, vol 33, No. 6, pp. 894-898.

43. Letter from Brian O’Neill, Insurance Institute for Highway Safety, to Jerry R. Curry, NHTSA, May 22, 1992, Comments Regarding MVMA Petition to Require Airbag Warning Labels, PRM-208-088.

44. Letter to the Editor, Airbag-Associated Rupture of the Right Atrium,” *New England Journal of Medicine*, February 4, 1993, p. 358.

45. *Status Report*, October 9, 1993, pp. 8-9.

State Farm used its 1994 study to examine the effects of manufacturers' design changes — the use of somewhat less powerful inflators, finer fabric weaves for the bags, and tethers. Although the sample was small, the results were consistent: all types of minor injuries were less frequent, for the face and all other body regions.

In March 1995 IIHS reported another analysis of NASS for 1989-1993. Out of an estimated 10.9 million crashes, there were an estimated 209,000 airbag deployments (actually 829 cases in the sample). An estimated 90,000 drivers and right-side passengers sustained 163,000 injuries from contact with airbags or airbag-generated gas. Ninety-six percent of the injuries were minor (AIS 1), about 3 percent moderate (AIS 2), and fewer than 1 percent worse. IIHS also mentioned 11 airbag-related deaths, two of which were unrestrained children, and others were being investigated. Again smarter, safer airbags were being touted for the future. Dual deployment-threshold airbags were already in use in Mercedes and BMWs, deploying at 9-12 mph when belts were used and at about 16 mph when they were not. A study by Transport Canada was cited to support the argument that such dual thresholds would reduce airbag-related injuries. A subsequent Transport Canada study suggested improvement could be achieved by simply increasing the deployment threshold.⁴⁶

Beginning in 1993, passenger airbags were also implicated in injuries and even deaths in low to moderate speed crashes, and as the years passed they accounted for more deaths than driver airbags, even though the front passenger seat is occupied less than half the time. Newspaper accounts of airbag-related deaths, which had focused on small, often elderly women drivers, were replaced by grisly and heartrending accounts of children suddenly dead, in at least one case decapitated, in low-speed crashes.⁴⁷ Almost all of the passenger airbag-related deaths were of children unrestrained in the front seat or of infants in rear-facing safety seats. The case of the unrestrained child was the one that had most concerned automobile manufacturers when they were arguing against airbags. More than once, as related in previous chapters, they withdrew this objection, saying that there were solutions. But when Ford proposed extending driver airbags credits, the automaker cited concern about the problem and the need to work on it as justification for the extension. Given the demand for passenger airbags and the expiration of the driver credit, no manufacturer used the issue of out-of-position children to avoid producing vehicles with passenger airbags.

While the attention paid by the media to airbag-related deaths and injuries probably reached its peak in 1996 and early 1997, the cases continued to accumulate. NHTSA concentrated its investigations of airbag crashes on cases involving deaths in low-speed crashes. Although by June 1, 1998, there were an estimated 75 million vehicles with driver airbags and slightly fewer than 47 million with passenger

46. *Status Report*, March 18, 1995, pp. 2, 4, 9; Dainius J. Dalmotas, et. al., "Airbag Deployment Crashes in Canada," DOT, NHTSA, *The Fifteenth Technical Conference on Enhanced Safety of Vehicles*, Melbourne Australia, May 13-16, 1996, pp. 155-168.

47. "Airbag aftermath," *Washington Post*, March 21, 1993, is a relatively mild example. A decapitation was reported in *The St. Louis Post Dispatch*, November 29, 1996.

airbags, airbag-related passenger deaths had overtaken those among drivers — 65 passenger deaths vs. 40 driver deaths. Of the 40 drivers, 22 were apparently unbelted; 30 were women, 12 of whom were 5'2" or shorter. Four of the 65 passengers were adults, the rest infants or children. Of the 48 children, 40 were apparently unrestrained. Ten out of the 13 infants were in rear-facing infant seats and 2 in adults' laps.⁴⁸

Because they were less dramatic than fatalities, there was far less publicity about airbag-related injuries. Based on analyses of 2,007 airbag deployments during 1989-1995 in NASS, Susan Ferguson, an IIHS researcher, reported that 42 percent of them resulted in airbag-related injuries. Ninety-seven percent of these injuries were minor, 2 percent were moderate, and 1 percent was serious.⁴⁹ Another study using NASS showed that the incidence of moderate or serious driver injuries in frontal crashes was less when airbags deployed than when there was no restraint, but somewhat greater than when drivers used lap/shoulder belts alone. Twenty-one percent of the driver airbag injuries were to the arm, compared with 11 percent of the injuries for the others.⁵⁰

Attitudes Toward Airbags

IIHS was still reporting very positive attitudes toward airbag deployments in early 1996. In a survey of both drivers and passengers involved in airbag deployments in Maryland, North Carolina, and South Carolina, 92 percent wanted their next car to have airbags. About 8 in 10 believed the bags protected them from injury.

When asked if they experienced any problems with the airbag deployment, 81 percent of drivers and 67 percent of passengers said they didn't. About 15 percent of passengers and 10 percent of drivers said they were coughing or had trouble breathing after the deployment. Very few among either passengers or drivers said they were injured by the airbag. Three percent of each group reported skin abrasions or burns. About 1 percent reported burning eyes.⁵¹

The public's continued faith in airbags seemed to be one reason why auto manufacturers generally won product liability suits involving airbags. Fear of losses in such suits and of problems getting product insurance coverage had been a persistent theme in manufacturers' opposition to airbags in the 1970s and '80s. Chrysler said that by August 1996 it had not lost a jury award in 200 cases alleging faulty airbags, and GM had won 11 of 12 jury verdicts. The companies attributed their track records to the quality of the product, but defense lawyers were worrying about the potential of suits brought by parents over the deaths of children from airbag deployments in low-speed crashes.⁵²

48. DOT, NHTSA, Special Crash Investigations, Summary Tables of Airbag-related Deaths, June 1, 1998, on NHTSA Airbag web site; Insurance Institute for Highway Safety, "Airbag Statistics," June 11, 1998, on IIHS web site.

49. Susan A. Ferguson, "Update on Airbag Performance in the United States: Benefits and Problems," presented at the Airbag 2000 Conference in Karlsruhe, Germany, November 26, 1996. This evidently updates the study cited in note 46 above.

50. Sheldon L. Stucki, et. al., "NHTSA's Improved Frontal Impact Program," SAE 950497, *Issues in Automotive Safety Technology: Offset Frontal Crashes, Airbags, and Belt Restraint Effectiveness*, SP-1072. Society of Automotive Engineers, Warrendale, PA, 1995. Pp. 279-291.

51. *Status Report*, February 3, 1996, pp. 6-7.

52. *Wall Street Journal*, August 14, 1996, p. 1A.

By June 1996 the media reports and official warnings about airbag-related injuries and deaths were beginning to have a measurable effect on public attitudes. A national survey by Roper Starch Worldwide for the Insurance Research Council reported that 51 percent were aware of potential problems with airbags. Fifty-nine percent were aware of the potential danger of children sitting in the front seat. Only 27 percent mentioned that this risk could be reduced by putting children in the rear seat. Still, 67 percent wanted airbags in their next car, slightly more among those with children under 13.⁵³ In a nationwide Gallup Poll in October 1996 sponsored by *USA Today*, 65 percent said that they would prefer to buy a vehicle with dual airbags, 13 percent with driver airbags, and 18 percent with no airbags at all. Seventy-seven percent said that a passenger airbag made the front seat more dangerous for children. Eighty-three percent had heard reports about the safety of airbags and small children.⁵⁴ IIHS did a more nuanced survey in January 1997 among drivers of vehicles with airbags in Michigan, North Carolina, and Texas; 42 percent believed airbags were very effective and 43 percent said they were somewhat effective. Fifty percent could name at least one problem with airbags — 35 percent mentioned dangers to children and 14 percent cited dangers to shorter or smaller people. While 73 percent did not want to disconnect their airbags, 19 percent said they would have their passenger airbag disconnected and 13 percent said they would disconnect their driver airbag.⁵⁵

The Effectiveness of Passenger Airbags

Although NHTSA and other airbag proponents continued to insist that the net effect of airbags was to save lives, no objective evaluation of passenger airbags was available until September 1996. Then the Insurance Institute for Highway Safety released an analysis based on FARS data.⁵⁶ Using the technique of comparing frontal and front-angle crashes to nonfrontal crashes, IIHS reported that there were 18 percent fewer passenger deaths in frontal and front angle crashes — 11 percent fewer in all crashes — in cars with passenger airbags than in those with driver airbags only. Among passengers reported to have been belted, the reduction was 15 percent, among the unbelted 22 percent. However, among children younger than 10, deaths were 33 percent higher than expected in frontal crashes.

In October 1996 NHTSA released a statistical study with results quite similar to those of IIHS.⁵⁷ There were about 18 percent fewer than expected deaths among right-front passengers 13 and older in *all frontal* crashes in cars with dual airbags; NHTSA emphasized the 27 percent reduction for this group in

53. Insurance Research Council, Press release on *Public Attitude Monitor 1996*, December, 1996.

54. *USA Today*, November 1, 1996, p. 1B.

55. *Status Report*, February 15, 1995, p. 3. A more complete report is in Michael X. Cammisa, Susan Ferguson, "Survey of Drivers of Airbag-Equipped Vehicles, Insurance Institute for Highway Safety," March 1997.

56. Susan A. Ferguson, Elisa A. Braver, Michael A. Greene, Adrian K. Lund, "Preliminary Report: Initial Estimates of Reductions in Deaths in Frontal Crashes among Right Front Passengers in Vehicles Equipped with Passenger Airbags," IIHS, September 1996.

57. Charles J. Kahane, *Fatality Reduction by Airbags: Analyses of Accident Data Through Early 1996*, Evaluation Division, Plans and Policy, NHTSA, August 1996. The NHTSA press release of the report was on October 3, 1996.

purely frontal crashes. But among children under 13 there was an increased risk of death, estimated in the report, but not in the press release, at 13.5 percent. The effectiveness of driver airbags was holding steady compared with earlier reports, and their effectiveness for light trucks was comparable to that for cars. There was, however, some evidence that driver airbags might be less effective for those 70 or older.

At the end of 1996 NHTSA published a little-noticed analysis of the injury-reducing effects of airbags as well as seat belts.⁵⁸ Based on modeling of data from NASS, it estimated that while manual lap/shoulder belts, when used, reduced the risk of receiving at least a moderate injury by 49 percent, and automatic belts did so by 43 percent, airbags plus lap/shoulder belts reduced the risk by 60 percent. But airbags alone reduced that risk only by 18 percent, a figure not statistically significant because of sample size. When the analysis was restricted to serious injuries only, MAIS 3+ rather than MAIS 2+, the advantage of airbags plus belts over manual belts disappeared.

A November 2001 update by NHTSA on restraint effectiveness showed minor changes in fatality reduction, but added greater changes in other injuries. Airbags with three point restraints reduced serious injuries by 68 percent; so did manual lap/shoulder belts when used. Airbags alone reduced serious injuries by 30 percent, which was not statistically significant because of sample size. Moderate injuries were 73 percent lower when lap/shoulder belts were used with airbags, 60 percent with lap/shoulder belts alone, and 29 percent (again not statistically significant) when airbags were the only restraint. Airbags plus lap/shoulder belts reduced the risk of both serious and moderate head injury by 85 percent; airbags alone reduced the risk of moderate head injury by 57 percent and of serious head injury by 43 percent.⁵⁹

In March 1997 NHTSA estimated that airbags had saved the lives of 1,639 drivers and 189 passengers since 1986. The comparable estimates for October 2003 were 10,8971 drivers and 2,500 passengers.⁶⁰

The Early Regulatory Response to Airbag Injuries

As evidence of airbag hazards increased, so did the pace and level of NHTSA's reactions.⁶¹ NHTSA issued a Consumer Advisory in December 1991, warning parents not to use rear-facing child seats in the front seats of vehicles with passenger airbags. Posting this warning on the sun visors in airbag-equipped cars was required by the September 1993 final rule implementing the airbag requirement. In February 1994

58. Department of Transportation, National Highway Transportation Safety Administration, *Third Report to Congress: Effectiveness of Occupant Protection Systems and Their Use*, December 1996, Exhibit 8 (the copy of the report on the NHTSA web site does not have page numbers).

59. Department of Transportation, National Highway Traffic Safety Administration, *Fifth/Sixth Report to Congress: Effectiveness of Occupant Protection Systems and Their Use*, November 2001, pp. 14-16.

60. Department of Transportation, National Highway Traffic Safety Administration, [Docket No. 74-14; Notice 114] Federal Motor Vehicle Safety Standards; Occupant Crash Protection, *Federal Register*, March 19, 1997, pp. 12960-12975; Department of Transportation, National Highway Traffic Safety Administration, "Special Crash Investigation Report," May 1, 1999 and October 1, 2003.

61. NHTSA's actions before August 1996 on airbag hazards are summarized in NHTSA, [Docket 74-14; Notice 100] FMVSS; Occupant Crash Protection; Notice of Proposed Rulemaking, *Federal Register*, vol. 61, No. 152, August 6, 1996, pp.40787.

NHTSA issued a regulation requiring rear-facing child seats to have a similar warning. In October 1994, the agency responded to a request from the American Automobile Manufacturers Association (AAMA, the new name for MVMA) by proposing to allow manual cutoff devices for passenger airbags in vehicles with no rear seat. In May 1995 a final rule was issued that also extended permission for cutoff switches to vehicles with rear seats too short to accommodate infant seats.⁶² Ford and, later, General Motors, were among the manufacturers that made cutoff switches available in some of their models.

On October 27, 1995, Dr. Ricardo Martinez, head of NHTSA, issued a strong warning to parents that children under 12 should ride in the rear seat whenever possible. If the child had to ride in front, the seat should be moved as far back as possible, and the child should always be restrained by a safety belt. This broadened previous warnings that had stressed the dangers of rear-facing infant seats. On November 9, 1995, NHTSA published a request for public comments on the design, track record, and dangers of airbags. It highlighted the concept of smart airbags, noting Ford's proposal to reduce the danger of injury from airbags by making the test speed for unbelted dummies 25 mph and that for belted dummies 35 mph.⁶³

Media reports of airbag injuries and deaths caused the Senate Commerce Committee to hold hearings during March 1996 on airbag safety. The testimony was full of assurances that airbags were still overwhelmingly saving lives. Putting children 12 and younger in the rear seat and using seat belts were the most immediate solutions recommended by all sides. Primary seat belt laws were favored as a key method for getting people to buckle up. The manufacturers also emphasized the need to change the requirements of FMVSS 208 to permit depowering, and some safety advocates, notably Brian O'Neill of IIHS, agreed emphatically. Although NHTSA Administrator Martinez noted all the technological fixes that were embodied in the notion of smart airbags, the industry warned that they were some years off.⁶⁴

On August 6, 1996, NHTSA proposed new warning labels and manual cut-off switches for vehicles that did not have smart passenger airbags.⁶⁵ The agency also proposed to define smart airbags broadly, in terms of the harm they would avoid, to give manufacturers flexibility in design choices, but left open whether they would be mandated or left to market forces.⁶⁶ In comments to the agency

62. National Highway Traffic Safety Administration, [Docket No. 74-14; Notice 94] Federal Motor Vehicle Safety Standards; Occupant Crash Protection; Final Rule, *Federal Register*, May 23, 1995, pp. 27233-27239. The initial proposal, Docket No. 74-14; Notice 92, was in *Federal Register*, October 7, 1994, pp. 51158, ff.

63. Department of Transportation, National Highway Safety Administration, [Docket No. 74-14; Notice 97] Federal Motor vehicle Safety Standard; Occupant Crash Protection; Request for comments, *Federal Register*, November 9, 1995, pp. 56554-56559.

64. *Airbag Safety*, Hearing Before the Committee on Commerce, Science, and Transportation, United States Senate, 104th Congress, Second Session, March 7, 1996. S. Hrg. 104-571.

65. Notice 100. See note 58.

66. The definition of smart airbags read:

"For purposes of this standard, a smart passenger airbag is a passenger airbag that: (a) Provides an automatic means to ensure that the airbag does not deploy when a child seat or child with a total mass of 30 kg or less is present on the front outboard passenger seat, or (b) Incorporates sensors, other than or in addition to weight sensors, which automatically prevent the airbag from deploying in situations in which it might have an adverse effect on infants in rear-facing child seats, and unbelted or improperly belted children, or (c) Is designed to deploy in a manner that does not create a risk of serious injury to infants in rear-facing child seats, and unbelted or improperly belted children."

manufacturers had confirmed that they were developing a variety of smart airbags, but it was not clear how soon they would be in production vehicles. Ford said they would be introduced gradually, during the next decade. GM was even vaguer. Mercedes said that, with regulatory approval, it could convert a device that deactivated the passenger airbag if the seat was unoccupied to one that would activate the airbag only if the seat were occupied by someone weighing at least 66 pounds. Some earlier comments from manufacturers of automobiles and airbags also wanted the manual cutoff option extended for a longer time or extended to all vehicles. IIHS and Advocates for Highway and Auto Safety generally opposed indiscriminate installation of cutoff switches.

NHTSA published its final rule on new warning labels on November 27, 1996.⁶⁷ New vehicles that did not have smart passenger airbags had to have three new “attention getting” warnings, two of them on the sun visors and a third on the dash. A new label, with stronger warnings, was also required on rear-facing infant safety seats. The agency was aware that warnings were not a cure, but said that focus group studies indicated that improved warnings might get the message to more parents and caregivers. In February 1996, IIHS reported on a national survey of 500 households, in which 75 percent knew that it was not safe to travel with a baby in a rear-facing car seat placed on a front seat with a passenger airbag. But 23 percent of the parents had traveled with infant seats in the front passenger seat.⁶⁸ By December 1996 a larger national poll had 88 percent saying it was important to put small children in the back seat when a car had a passenger airbag, but 10 percent still thought it was unimportant.⁶⁹

As publicity about airbag-related deaths and injuries mounted, other government bodies expressed concern. The National Transportation Safety Board (NTSB) released a study in September 1996 with numerous recommendations for NHTSA, manufacturers, and state governments.⁷⁰ It found that passenger airbags were not acceptable for protecting children, nor were any of the immediate fixes being considered by NHTSA likely to change this situation. The NTSB also said that NHTSA should consider remedies for passenger airbags already installed, and that passenger airbag standards, especially those for advanced (which many were still calling “smart”) airbags, should reflect actual crash conditions, like pre-impact braking, the presence of out-of-position children (both belted and unbelted), and the passenger seat being pushed close to the front panel. Governors were urged to heed previous calls for primary seat belt use laws (only 11 states had them in July 1996), to emphasize to the public the need to keep children restrained and in back seats, and to be sure that state laws required children up to 8 years old to use child restraints or booster seats. Older children should be covered by seat belt use laws.

67. NHTSA, 49 CFR Part 571 [Docket 74-14; Notice 103] Federal Motor Vehicle Safety Standards; Occupant Crash Protection. Final Rule. *Federal Register*, November 27, 1996, pp. 60206-60221.

68. *Status Report*, February 3, 1996, p. 6.

69. “Airbag Poll,” Associated Press, December 20, 1996, as relayed by the Executive News Service.

70. *SAFETY STUDY: The Performance and Use of Child Restraint systems, Seatbelts, and Airbags for Children in Passenger Vehicles*, vol. 1: Analyses. National Transportation Safety Board, Washington, D.C., September 1996.

In a press release on November 22, 1996, along with its final rule on airbag warning labels, NHTSA outlined its plans to reduce airbag dangers to children and at-risk adults. The ultimate objective was to require manufacturers to phase smart airbags into vehicles in two years, beginning with the 1999 model year. NHTSA planned to issue an NPRM to define these airbags early in 1997. But before that it would try to reduce airbag injuries and deaths by allowing airbags to be inflated more slowly, to be deactivated at the consumer's request, and to have cutoff switches in vehicles without rear seats until model year 2001. The strategy was topped off by a public awareness drive, coordinated with The National Airbag Safety Campaign, as well as expanded research to improve airbag testing and crash protection for children and women.⁷¹

In a later interview, NHTSA Administrator Martinez outlined the priorities underlying the plan:

Three basic principles were overriding (sic) the airbag debate in my mind. First, we had to make a fundamental policy decision that we put children and at risk adults ahead of other people... We placed the priority on children. That's what we had to do. That's number one. So we were willing to lose the lives of young adults to save children. That was a tough decision, quite frankly. But given that we had a one size fits all technology that clearly didn't work we had to make a policy decision. That was my first decision. The second was to work with as many groups as possible to implement solutions as quickly as possible. And the third thing was to move as quickly as possible.⁷²

As we shall see, the "tough decision" to give a higher priority to children's lives was made fairly explicit in the rule-making process and widely supported by those commenting on the proposals.

On December 28, 1996, President Clinton expressed his concern about airbags and child safety in his regular Saturday radio talk and set the stage for three notices to be announced by NHTSA the next working day. According to Martinez, the President's staff had been following developments at NHTSA rather than setting policy. The issue was selected as a family-oriented theme suitable for the last radio talk of the year. Clinton added to his plea for wearing seat belts an instruction that the Secretary of Transportation submit to him a plan for increasing their use.

Although there was general support for NHTSA's strategy of searching for quick fixes and promoting seat belt use while encouraging development of smart airbags, there were disagreements about the fixes. The most thoroughgoing dissents came from three groups that tended to have almost identical positions — Public Citizen, the Center for Auto Safety and a new group, the Parents Coalition for Airbag Warnings, started by parents whose children were killed in airbag deployments, and later renamed Parents for Safer Airbags. Joan Claybrook of Public Citizen was the most articulate spokesperson for these groups. They called for dual airbags, with deployment thresholds and degrees of force that would vary with collision speeds and belt use; for a 15 mph deployment threshold (higher than the current

71. *New York Times*, November 23, 1996, p. 1; Department of Transportation News Release, "NHTSA Announces Comprehensive Plan to Improve Airbag Technology and Reduce Airbag Dangers," November 22, 1996.

72. Interview with Ricardo Martinez, M.D., February 3, 1998.

approximate 10 mph threshold); and for airbags that deployed vertically. The groups wanted the first two changes incorporated into FMVSS 208; NHTSA noted that these two proposals were not ruled out by the standard. However, both IIHS and NHTSA said that the analysis of vertically deploying airbags was flawed.⁷³ Later, IIHS compared the deployment profiles of two airbags supposed to deploy in predominantly vertical modes and two that were supposed to have horizontal deployments. All inflated in three directions, and it was difficult to say which direction predominated.⁷⁴

One of the three notices issued on January 6, 1997, was uncontroversial — a final rule extending permission to manufacturers to offer cutoff switches for passenger airbags in vehicles without rear seats or with rear seats too small for rear-facing infant seats.⁷⁵ The rule was uncontroversial just because it did not extend this permission to all vehicles. Most manufacturers, except Volvo and BMW, had opposed such a blanket extension. So had insurance groups, IIHS, and most other health and safety groups.

While the other NPRMs issued at the beginning of January were awaiting comments, NHTSA held a technical workshop to discuss smart airbags, particularly the development of technology to avoid harm caused by passenger airbags. Representatives of airbag providers touted their progress, but the automakers' representatives maintained that the technology was not sufficiently developed to define the tests for a smart airbag standard. If NHTSA moved too quickly to establish tests, it could discourage some experimentation. IIHS agreed with this argument. The spokesman for the American Automobile Manufacturers Association said his group

recommends the principles for future design should be clearly established to maximize protection for belted occupants while minimizing harm to children and small statured adults; then, provide the highest feasible protection for unbelted adults.⁷⁶

The American Occupants Restraint Council, the trade organization of airbag and seat belt makers, also noted that smart restraints could not only avoid harm, as NHTSA had specified, but could also optimize protection in some circumstances. Some time after the workshop, NHTSA replaced the catchy phrase “smart airbags” with the more pedestrian “advanced airbags.” NHTSA deferred defining “advanced airbags” any more precisely, but said in November 1997 that a proposal to require their installation was expected “this winter.”⁷⁷

73. Joan Claybrook, President of Public Citizen, “Statement on FMVSS 208 and Airbags,” House of Representatives, Committee on Appropriations, Subcommittee on Transportation and Related Agencies, December 19, 1996; Center for Auto Safety, Comments to Docket on N 107 and N 108, February 5, 1997; Public Citizen, Press Release, “Airbag Study Shows Huge Variation in Safety Record,” July 3, 1997; *New York Times*, July 6, 1997, p. A-12; *The Airbag Crisis: Causes and Solution*, Parents for Safer Airbags, October 1997.

74. Susan A. Ferguson, “An Update on the Real-World Experience of Passenger Airbags in the United States,” Airbag 2000+: Fourth International Symposium on Sophisticated Car Occupant Systems, Karlsruhe, 1998.

75. Department of Transportation, National Highway Traffic Safety Administration, [Docket 74-14; Notice 109] FMVSS; Occupant Crash Protection. Final Rule. *Federal Register*, January 6, 1997, pp.798-806.

76. Statement of Vann H. Wilbur, in *Transcript of NHTSA, Smart Airbag Public Meeting*, February 11, 1997.

77. Department of Transportation, National Highway Transportation Safety Administration, 49 CFR Parts 571 and 595 [Docket No. NHTSA-97-3111] RIN 2127-AG61; Airbag On-Off Switches; Final Rule *Federal Register*, vol. 62, No. 225, November 21, 1997, p. 62409.

NHTSA did act fairly promptly on its proposal to allow manufacturers to “depower” airbags by 20 to 35 percent as a method of reducing airbag-related fatalities in low speed crashes while keeping most of their effectiveness in high speed crashes.⁷⁸ Two approaches were being considered. One was to raise the chest injury criteria for the unbelted; the other, requested by AAMA, was to replace the unbelted crash test with a sled test. The sled test would use a longer deceleration period than occurs in a barrier crash, allowing airbags to deploy with less force but still protect unbelted occupants. NHTSA was concerned that either proposal might result in killing more unbelted occupants than in saving lives. Also, should there be a sunset provision? One possibility contemplated by NHTSA was to end permission for depowering once smart airbags began to be installed on a mandated schedule, then projected to begin on September 1, 1998.

NHTSA issued a final rule on March 14, 1997, allowing manufacturers to depower airbags until September 1, 2001.⁷⁹ This “sunset” provision was almost immediately criticized by both manufacturers and IIHS on the grounds that depowering would save lives and should not be phased out without serious consideration. More than a year later, Congress passed a law allowing manufacturers to continue depowering until a rule for advanced airbags was issued.⁸⁰

The depowering regulation permitted the use of AAMA’s modified unbelted sled test, rather than allowing an increase in the chest loads for unbelted occupants in crashes. Almost all the comments received favored depowering, although foreign manufacturers also stressed replacing the unbelted test with a belted one.⁸¹ Much discussion centered around the apparently favorable experience with depowered airbags in General Motors’ Holden cars sold in Australia, which were designed to work with seat belts. Belts were worn by more than 90 percent of vehicle occupants in that country.⁸² The Center for Auto Safety and the Parents Coalition for Airbag Warnings were among the few groups that opposed depowering for fear that deaths would increase among unbelted adults. NHTSA shared some of these concerns, but said:

While the agency recognizes the possibility that there is a potential for net disbenefits from depowering, it believes it must consider both the short run and long-run implications of this rulemaking on safety. Ultimately, the continued availability of any safety device as standard equipment, whether provided voluntarily by manufacturers or pursuant to a regulation, is dependent on consumer acceptability. The agency believes that airbags which fatally injure occupants, particularly children in low speed crashes, place the concept of airbags at risk, despite their overall net safety benefits. Accordingly, to help assure that airbags remain acceptable to consumers and ultimately achieve their full potential in the future, the agency believes it is reasonable to accept some short term safety tradeoffs associated with depowering, while better solutions are being developed.

78. Department of Transportation, National Highway Traffic Safety Administration, [Docket No. 74-14; Notice 108], NPRM. *Federal Register*, January 6, 1997, pp. 807-831.

79. Department of Transportation, National Highway Traffic Safety Administration [Docket 74-14; Notice 114] Federal Motor Vehicle Safety Standards; Occupant Crash Protection, *Federal Register* March 19, 1997, pp. 12960-12975.

80. Public Law 105-178, section 7103 (a) (4). The Department of Transportation refers to the law as TEA 21. See below for other provisions related to advanced airbags and state seat belt use.

81. Association of International Automobile Manufacturers comment to Docket 74-14, No. 108, February 5, 1997.

82. Notice 114, p. 12969

NHTSA also notes that, as discussed in the NPRM, it believes that even if the net effect were negative, the opportunity to avoid the deaths of a significant number of children who would otherwise be injured by airbags justifies foregoing the opportunity to save some unbelted teenage and adult passengers.⁸³

Both AAMA and IIHS had argued that NHTSA was too pessimistic in estimating the number of adult deaths that might be caused by depowering,⁸⁴ but as is shown in the quotation above, NHTSA made its decision almost in spite of those estimates.

Soon after the depowering rule was issued, Ford announced that it would put depowered airbags in all its 1998 model vehicles, and Chrysler said it would do the same except for one sports car. Other auto manufacturers had more gradual plans for depowering. However, most 1998 American vehicle models had depowered air bags.⁸⁵ IIHS continued to believe that depowered airbags would have beneficial effects and asked for the elimination of the sunset clause.⁸⁶

Of the proposals it issued on January 6, 1997, Notice 107 was the most troublesome to NHTSA. The agency proposed, apparently with reluctance, to allow owners to have driver or passenger airbags deactivated by vehicle dealers and repair businesses, something that was illegal up to then.⁸⁷ Vehicle owners would be required to get NHTSA information sheets about when deactivation was appropriate and the risks involved and to sign statements of informed consent; warning labels would also be installed in the affected vehicles. Deactivation would not be permitted if there was already a cutoff switch or if the vehicle had smart airbags. NHTSA noted that deactivation would be in the best interests of occupants “only in limited instances.”

NHTSA received many more comments from the public favoring deactivation than opposing it. Fear of airbags was frequently supported with citations of two scary columns by Joan Beck in the *Chicago Tribune*. In contrast, virtually all organized groups opposed the idea of deactivation unless each deactivation was formally approved by the agency itself. General Motors, for example, doubted that NHTSA had the legal authority to allow deactivation without reviewing individual cases and thought cutoff switches, rather than mechanical disabling, should be the only method permitted. BMW and Volvo had been cited by NHTSA as supporters of the deactivation idea, but they now joined their competitors in supporting deactivation only after NHTSA conducted individual case reviews.⁸⁸ There were two

83. Op. cit., p. 12964.

84. Letter from Vann H. Wilbur, AAMA to L. Robert Shelton, Associate Administrator, NHTSA, on information requested 12/19/96, January 8, 1997. [74-14-N108-099]; Adrian K. Lund, IIHS to Ricardo Martinez, MD, NHTSA, Comments on 74-14; Notice 108. February 5, 1997. Both AAMA and IIHS also asked NHTSA to add a test for out of position occupants to FMVSS 208.

85. Newsday, April 25, 1997; Peter Weiss, “Curbing Airbags’ Dangerous Excesses,” *Science News*, September 26, 1998, p. 206.

86. Susan Ferguson, IIHS, Letter to R. Martinez, NHTSA, 74-14-No. 113, June 4, 1997.

87. Department of Transportation, National Highway Traffic Safety Administration, [Docket 75-14; Notice 107] Airbag Deactivation, NPRM. *Federal Register*, January 6, 1997 pp.831-844.

88. For the letters see the analysis by Amy Feldman, IIHS, “Memo on docket comments on Notice 107,” January 31, 1997; the raw materials are in “Comments submitted to NHTSA’s Docket 74-14 Notice 107, February 5, 1997.” Almost every manufacturer and automobile trade association submitted a statement to the docket opposing the proposal in Notice 107.

exceptions to the opposition to deactivation, Jim Hall, chair of the National Transportation Safety Board, and Brian O’Neill of IIHS. Although both agreed that very few people would benefit from deactivation, they feared pressure to repeal the airbag requirement would become overwhelming unless it was relieved by this safety valve.⁸⁹ However, on March 5, 1997, the heads of major insurance companies that supported IIHS, along with the chief executives of all the major automobile manufacturers, sent a letter to Secretary of Transportation Rodney E. Slater protesting the “broad, on demand, deactivation policy” in Notice 107. A coalition of auto companies, auto retailers, insurers, safety groups, and physicians worked during the spring and summer to head off the proposal. In August the coalition told the agency that it should have no trouble screening all written requests for airbag deactivation since it was currently answering all of them within 72 hours. Then, fearing that NHTSA had already decided on deactivation on demand, the coalition met with the agency that reviews all proposed regulations — the Office of Management and Budget — to urge that permission be granted only to people in groups at risk, and only after NHTSA had reviewed each application. Representatives of the coalition repeated their case before NHTSA in August and then again before OMB in October.⁹⁰ Administrator Martinez has said that these meetings helped to sensitize him to the concerns of the coalition, but that much of the discussion was on deactivation, which by then NHTSA was not proposing.⁹¹

Instead of allowing deactivation, the final rule, issued on November 18, 1997, permitted installation of on-off switches, but only after NHTSA determined that applicants, or users of their vehicles, belonged to defined risk groups.⁹² When the NPRM had been issued, many manufacturers said that they could not provide aftermarket on-off switches very quickly. But many had since acquired that capability, or were about to, which made the on-off switch more attractive to the agency than the hard-to-reverse step of deactivation. Applicants had to affirm that they had read the NHTSA brochure, which defined risk groups and described the easy steps by which almost everyone could reduce their risk, including using seat belts, sitting as far back from the airbag cover as possible, and always putting children in the rear seat, restrained. The four risk groups were:

- infants in rear facing car carriers who could not be placed in the rear seat,
- drivers or passengers with unusual medical or physical conditions,
- children aged 1 to 12 who could not be placed in a rear seat, and
- drivers who could not get back at least 10 inches from the steering wheel.

89. See Brian O’Neill, Letter to Ricardo Martinez, M.D., NHTSA, February 5, 1997, on NHTSA Docket No. 74-14; Notice 107; also Status Report, February 15, 1997, p. 7; Testimony of Jim Hall, Chairman, NTSB, Before the Senate Commerce, Science and Transportation Committee, Regarding the Dangers of Airbags to Infants and Small Children, January 9, 1997.

90. Airbag On-Off Switches; Final Rule, *Federal Register*, pp. 62414-62415.

91. Martinez Interview.

92. The final rule was extraordinarily lengthy and defensive; “Airbag On-Off Switches; Final Rule,” *Federal Register*, vol. 62, No. 225, November 21, 1997, pp. 62406-62455.

A medical panel convened by NHTSA had explained that there were very few medical conditions that required occupants to avoid possible airbag deployments.⁹³ Research by IIHS was cited as the basis for saying that very few women drivers under 5'2" were unable to sit 10 inches from the steering wheel after being shown how to do it.⁹⁴ Although NHTSA feared the consequences of improper or forgetful use of the on-off switch, it noted the results of two driver surveys by IIHS. In the first, a poll of drivers of airbag-equipped vehicles in three states, 76 percent said that they wanted at least driver airbags in their next car, but 30 percent wanted an on-off switch for the driver and 67 percent wanted it for the passenger airbag. In a second survey of a comparable sample, IIHS found that 79 percent wanted airbags in their next vehicle; 16 percent would be willing to pay for an on-off switch for the driver, 23 percent for the passenger. After they were read a statement about the benefits of airbags and the easy steps that would overcome their risks, the percentages that still wanted an on-off switch dropped to 12 for the driver side and 16 for the passenger.⁹⁵ As with the final rule on depowering, and using some of the same words, NHTSA stressed the effect that the new on-off switch rule would have on public opinion, especially on improving attitudes toward airbags:

NHTSA is issuing this final rule, notwithstanding its potential to reduce the number of lives saved by airbags, because the agency believes that it must consider both the short-run and long-run implications of this rulemaking on safety. Ultimately, the continued availability and use of any safety device, whether provided voluntarily by manufacturers or pursuant to a regulation, is dependent on public acceptability. The agency believes that airbags which fatally injure occupants, particularly children in low speed crashes, weaken the acceptability of airbags, despite their overall net safety benefits. Accordingly, to help ensure that airbags remain acceptable to the public and ultimately achieve their full potential in the future (as advanced airbags are developed and introduced), the agency believes it is reasonable and appropriate to give persons in risk groups the opportunity to obtain and use an on-off switch, upon the making of the requisite certifications on the agency request form and obtaining agency approval for each request.⁹⁶

NHTSA discerned a distinct improvement in the public's attitude toward airbags between early 1997 and the period just before it issued its on-off switch rule, evidenced by the decreased interest in switches, as reported in IIHS surveys. The wave of child fatality reports featured in the media in January had been followed up by hearings and public information campaigns — most notably the Airbag Safety Campaign — aimed at assuring the public of the benefits of airbags and the ease with which most people

93. The Ronald Reagan Institute of Emergency Medicine, Department of Emergency Medicine, and the National Crash Analysis Center, The George Washington University Medical Center, National Conference on Medical Indications for Airbag Disconnection: "Final Report," July 16-18, 1997, (NHTSA Web site).

94. The full report was published later in Doreen M. De Leonardis, Susan A. Ferguson, Janella F. Pantula, Survey of Driver "Seating Positions in Relation to the Steering Wheel," Insurance Institute for Highway Safety, December 1997.

95. Michael X. Cammisa, Susan A. Ferguson, "Survey of Drivers' Attitudes Toward Airbags and Deactivation," Insurance Institute for Highway Safety, November 1997; Michael X. Cammisa, Susan A. Ferguson, "Survey of drivers of Airbag-Equipped Vehicles," IIHS, March 1997; "Airbag On-Off Switches, Final Rule," p. 62424. The data cited are from the later IIHS report; they differ somewhat from the figures in the final rule.

96. *Ibid.*, p. 62439.

could avoid their dangers. The most pessimistic reaction among experts had come from John Graham of the Harvard School of Public Health, who told the National Transportation Safety Board that the benefits of driver airbags had been oversold even though they were about as effective as most other preventive medicine remedies. They had reduced deaths among unbelted drivers by only 13 percent, he said, while the promise had been 30 percent. Passenger airbags were even more oversold and were killing more children than they were saving. “Taking into account risk, cost, and benefit, my own opinion is that the current passenger-side airbag is not acceptable,” Graham declared. He said that a survey done by his Center for Risk Analysis showed that the public overvalued airbags and misunderstood their risks and how to deal with them.⁹⁷ However, Graham also felt that if all children occupied the back seat and were restrained, this would “move the passenger-side airbag into a more acceptable situation” because the “cost per quality adjusted life” would be reduced from \$400,000 to \$104,000 (compared with \$70,000 per life saved by driver airbags).⁹⁸

The public’s reaction to the availability of on-off switches may be taken as evidence either that airbags’ image is “teflon,” as Graham contended, or that the Airbag Safety Campaign — described below — was extraordinarily effective in educating the public about the benefits of airbags and how to avoid their dangers, as Administrator Martinez contended. By the end of February 1998, *The New York Times* reported that applications for on-off switches were coming into NHTSA at a rate of about 100 to 200 a day; a total of 18,000 had been received. By the beginning of June 1998, 30,594 authorizations had been granted — 23,861 for the driver side and 14,018 for the passenger side. Fifty-four percent of the latter were for problems involving children; 32 percent were for medical conditions. Seventy-nine percent of driver authorizations involved distance from the steering column. But NHTSA knew of only 1,065 on-off switch installations. In its last summary posted on the Internet NHTSA reported total on-off switch authorizations of 57,183, with 11,195 installed.⁹⁹ There were no major changes in the reasons for authorizations, but there were indications that dealers and repair businesses had been refusing to install

97. Statement of John D. Graham, Professor of Policy and Decision Sciences, Harvard School of Public Health, to National Transportation Safety Board Supplemental Restraint Panel. March 17, 1997. Among the misconceptions in the survey cited by Graham were: 59 percent believe airbags save more children’s lives than they kill; 74 percent believe it is safe for children under 12 to ride in the front seat; 78 percent believe that a driver’s risk of injury from an airbag is minimal if he wears a safety belt. [Almost all experts share the last “misconception.”] But the same survey cited as “knowledge” that 67 percent recognize it is dangerous to place an infant in a rear-facing carrier in the front seat; 71 percent recognize that a driver sitting too close to the wheel can be injured or killed by the airbag; 68 percent recognize that more female drivers have been saved than killed by airbags. “The Airbag’s Teflon Image: A National Survey of Knowledge and Attitudes,” Center for Risk Analysis, Injury Control Center, Harvard School of Public Health, March 17, 1997.

In a cost-benefit analysis published later in 1997, based on NHTSA and IIHS statistical evaluations, Graham and associates showed that driver-side airbags were cost beneficial, but questioned the mandating of passenger airbags, given their effect on children. John D. Graham, Kimberly M. Thompson, Sue J. Goldie, Maria Segui-Gomez, Milton C. Weinstein, “The Cost-effectiveness of Airbags by Seating Position,” *Journal of the American Medical Association*, vol. 278, No. 17, November 5, 1997, pp.1418-1425.

98. National Transportation Safety Board, *Proceedings*, March 17-20, 1997, p. 372

99. National Highway Traffic Safety Administration, “ON-OFF Switch Request and Authorization Summary,” weeks ending 6/6/98 and 10/30/99,” on NHTSA Web site.

the switches because of fear of liability. NHTSA posted a “Special Message for Dealers and Repair Businesses” on the Internet assuring them that the chances of a liability suit were very slight and asking them to allow their names to be listed on its site of businesses willing to install switches. The list was not very extensive; for example, by July 10, 1998, there were 19 businesses listed for all of California and one for Alabama. NHTSA’s assurances had some effect — by May 18, 1999, there were 48 businesses listed for California and 5 for Alabama.

Seat Belt Use as a Solution to Airbag Injuries

By May 1996 private interests were sufficiently worried about the reaction to airbag injuries and deaths that they joined the government in a coalition to prevent these dangers. In a press release on May 21, 1996, Secretary of Transportation Federico Pena announced that automobile manufacturers, airbag suppliers, insurance organizations, and safety groups had joined the federal government in a campaign with three objectives, all involving primarily seat belt use rather than airbags themselves:

- to educate drivers, parents and care givers about proper seat belt and child safety seat use, especially in vehicles with airbags;
- to lobby for primary seat belt use laws, which were in force in only 11 states and were significantly more effective than the secondary laws that were in force in 37 states;
- to increase enforcement of all seat belt and child seat use laws.

Coalition members pledged \$10 million to the privately funded Airbag Safety Campaign.

Basic to the Airbag Safety Campaign was the acknowledgment by coalition members that proper seat belt use was the key to safer, more effective airbags. A survey of airbag technology trends in October 1996 noted:

When the subject of SIRs [supplemental inflatable restraints] comes up with auto industry engineers, talk invariably reverts to seat belts. They stress that although airbags are an important safety device, they should always be treated as supplements to a properly worn seat belt, thus the term supplemental inflatable restraint. That underlying theme with all the talk about airbags is one of the drivers of airbag development and its role in the refinement of the total occupant protection system.¹⁰⁰

An IIHS report in 1992 had claimed that this position reflected an even wider agreement:

There is now a strong consensus in the United States that the combination of an airbag and a lap/shoulder belt is the best occupant protection system currently available, and all auto manufacturers are promoting airbags as supplementary protection to belts. There is less agreement on the value of airbags when belts are not worn...

100. Kevin Jost, “Airbag technology trends,” *Automotive Engineering*, October 1996, pp. 67-72. See, also, a more general statement from German engineers:

“The utility of airbag systems is incontestable, as demonstrated by the reports of accident researchers, doctors, and insurance companies. Just as clear, however, is the realization that an airbag system — as valuable and important as it is — can merely be a part of a comprehensive concept of occupant security. The use of safety belts remains the most important measure for the prevention or reduction of accident injuries.”

Hiltman Schubert and Karl-Friedrich Ziegahn, “Technological Trends in Occupant Protection Systems — Recent Research Challenges from the German Point of View,” SAE 960663, *Occupant Protection Technologies for Frontal Impact: Current Needs and Expectations for the 21st Century*, SP-1144. Society For Automotive Engineers, Warrendale, Ohio, 1996, p. 86.

From a public health perspective, seat belts and airbags should be thought of as complementary systems. Although the airbag supplements the protection offered to belted occupants, it also offers protection for unbelted occupants in frontal crashes...¹⁰¹

More recently both Brian O'Neill of IIHS and Ford's Helen Petruskas have used almost the same words, describing lap/shoulder belts and airbags as working together as a system, but with airbags being secondary.¹⁰²

The president of the American Automobile Manufacturers Association said that this view of airbags as secondary restraints established that passive restraints were an illusion:

We now have enough experience with airbag technologies to recognize that the concept of airbags as "passive" restraints — requiring no action by occupants to receive a safety benefit in a crash — is an illusion we can no longer afford to pursue. In fact, we are learning just the opposite — that is, with an airbag safety belt use becomes even more important. Airbags are a supplemental restraint technology able to provide maximum benefit only when occupants are belted. After depowering, and after "smart" airbags are implemented, occupants will still have to be belted to reduce the risk of collision related injury...¹⁰³

Arguments about passivity and primacy were rapidly becoming moot because airbags and seat belts reinforced each other in increasingly complex ways as safety technology developed. Being properly buckled kept occupants in position when airbags deployed during a crash. Airbag technology also was used to make belts more effective through belt pretensioners that tighten the belt during a crash, keeping the occupant in place more effectively. The pretensioner is actuated by the same crash sensor that deploys the airbag and the tightening force comes from solid state propellants developed for use with airbags. The presence of airbags also made it less risky for force limiters to be installed in the chest portion of the belts; these allow belts to give way slightly, reducing the likelihood of chest trauma. Pretensioners and force limiters, as of model year 2001, were available in almost all passenger cars and were sometimes standard.¹⁰⁴

101. Brian O'Neill, Adrian K. Lund, "The Effectiveness of Airbags in Preventing Driver Fatalities in the United States," *Proceedings of the International Conference on Airbags and Seat Belts: Evaluation and Implications for Public Policy*, October 18-20, 1992 *Chronic Diseases in Canada*, Vol. 14, no. 4, Supplement Autumn 1993, p. S53.

A senior GM safety engineer stated the complementarity somewhat differently:

"Airbags and safety belts are now viewed as complements for occupant protection in a crash....While safety belts effectively prevent fatal injuries, they must be worn to protect vehicle occupants. Safety belts provide the greatest relative effectiveness in rollover crashes, where airbags provide little protection. However, the greater load distribution provided by airbags in frontal crashes enhances the protection of safety belts and provides substantial protection for unbelted occupants."

David C. Vianno, [GM], "Restraint Effectiveness, Availability and Use in Fatal Crashes: Implications to Injury Control," *Journal of Trauma*, vol 38, No. 4, April 1995, p. 538.

102. National Transportation Safety Board. 1997. *Proceedings*, March 17-20, pp. 148, 149, 151.

103. Andrew H. Card, Jr., President and CEO, American Automobile Manufacturers Association, Statement to House of Representatives, Committee on Appropriations, Subcommittee on Transportation and Related Agencies, December 19, 1996.

104. Telephone and e-mail discussions with Brian O'Neill, July 13 and 27, 2001. See also H. John Miller, "Occupant Performance with Constant Force Restraint Systems," SAE Technical Paper Series, 960502, Warrendale, PA, 1996.

After his brief call in December 1996 for a plan from the secretary of transportation to increase seat belt use, President Clinton sent a more detailed letter of instruction in January, 1997. He asked for a plan that would address state belt use laws, and DOT assistance in improving those laws, as well as a public education campaign. The plan was published in April 1997. It set national goals of 85 percent belt use by 2000 and 90 percent by 2005 (from 68 percent in 1996), and also goals to reduce occupant fatalities among children 4 and younger by 15 percent in 2000 and by 25 percent in 2005 (from a total of 685 in 1996). In the style of the Clinton administration, the plan for achieving these goals was to include “public-private partnerships;” enactment of both strong state primary seat belt use laws and laws closing the gaps in vehicle safety provisions for children up to age 16; high visibility enforcement of these laws following the examples of North Carolina and Tennessee; and public education on the benefits of safety belt and child restraint use.¹⁰⁵

DOT’s ability to motivate states to adopt highway safety standards had been weakened by Congress in 1976 and 1987, so that by 1997 it had only the power of persuasion to get states to pass more effective and thorough belt use laws.¹⁰⁶ The new seat belt plan included an earlier Clinton administration proposal that Congress fund incentive grants to the states to improve their occupant protection laws and seat belt use rates. Also beginning in fiscal year 2003 DOT was to have the authority to transfer a percentage of highway construction funds to safety programs if a state had not passed a primary seat belt use law or had failed to reach specified belt use levels.¹⁰⁷ According to Martinez, Congress never accepted these proposals “because of states’ rights.” But when a comprehensive transportation act was finally passed and ratified in June 1998, it did contain incentives — \$500 million for fiscal years 1999-2003 for states to increase seat belt use rates and \$83 million over the same period to states that adopted innovative safety programs like primary seat belt or special traffic enforcement laws.¹⁰⁸

Early in 1998, before Congress reinstated some fiscal incentives for seat belt use laws, NHTSA reviewed the accomplishments of its seat belt plan. NHTSA claimed some credit for adoption of primary seat belt use laws in Oklahoma, Maryland, and the District of Columbia, and for New Hampshire and Virginia upgrading their child passenger laws to include all those up to ages 18 and 16, respectively. But highly visible enforcement of seat belt laws had still not become a widely accepted police strategy despite the examples of Canada and North Carolina. From a statewide belt use rate in 1992 of 62 percent, around the national average, North Carolina quickly reached the 80 percent level through a program of publicity and repeated enforcement campaigns.¹⁰⁹ Martinez claimed that 92 percent of the public had been exposed

105. Department of Transportation, *Presidential Initiative for Increasing Seat Belt Use Nationwide: Recommendations from the Secretary of Transportation*, DOT Web site, nd, but probably late April or May 1997.

106. Department of Transportation, National Highway Traffic Safety Administration and Federal Highway Administration, 23 CFR Parts 1200 and 1205 [NHTSA Docket No. 93–55, Notice 5] *Federal Register*, June 26, 1997 pp.34397- 34405.

107. Presidential Initiative for Increasing Seat Belt Use Nationwide, p. 12.

108. DOT’s Analysis of TEA-21 – Transportation Equity Act for the 21st Century, DOT web site; Martinez Interview.

109. *Status Report*, December 20, 1993, pp. 1-5, and February 15, 1997, p. 6; Williams, A.F., Reinfurt, D.W., and Wells, J.K., “Increasing seat belt use in North Carolina,” *Journal of Safety Research*, 1196, vol 27, pp. 33-41.

in one year to the messages of the Airbag Safety Campaign, and the campaign was extended to the year 2000 in support of the long-range belt use plan.¹¹⁰ Primary seat belt use laws (now dubbed ‘standard’ by their promoters) spread slowly. By the end of 2000 they were in force in 17 states and the District of Columbia. In September 2003 that had grown to 22 states plus D.C, but all U.S. jurisdictions except New Hampshire had mandatory seat belt use laws. Although under TEA-21 Congress authorized \$500 million to be divided among the states in fiscal years 1999-2003 to encourage seat belt use, only \$83 million was authorized for the same period for a program that included adopting or demonstrating primary enforcement laws. Child safety seat use was also to be promoted under the \$83 million. By August 2003 all states and D.C. had child restraint laws but the ages covered and the responsibilities of adults varied considerably.¹¹¹

Seat belt use continued to grow toward the end of the millennium, from 61 percent in 1996 to 71 percent in 2000 and 79 percent in 2003. Although there continued to be a significant difference between secondary and primary enforcement states, *usage* grew in both groups. Still, even in primary enforcement states, the use rate was at 83 percent, far below Canada’s.¹¹² However, both the states of California and Washington achieved belt usage over 90 percent through strict enforcement of their primary laws.¹¹³

Defining Advanced Airbags

Defining “advanced airbag technology,” was, in early 1999, the key unfinished business in NHTSA’s strategy for dealing with airbag injuries. Automobile and restraint manufacturers and the Insurance Institute for Highway Safety issued a joint statement of recommendations on the subject in March 1998. The actions it recommended were:

- Continue support for educating the public on airbag and seat belt safety and for enacting and enforcing primary seat belt use laws.
- Establish priorities for occupant protection.
- Assure that future airbag rules are objective, practicable, meet the need for motor vehicle safety, and are performance based and data-driven.
- Retain the current mid-size male, unbelted, high-speed sled test until other, more appropriate tests for assessing unbelted protection can be developed.
- Avoid arbitrary lead-times (sic) and deadlines which may inadvertently inhibit innovation and result in unintended consequences.
- Undertake a thorough and timely real-world evaluation of the safety effects of depowering.

110. Department of Transportation, National Highway Transportation Safety Administration, *Buckle Up America. The Presidential Initiative for increasing Seat Belt Use Nationwide*: House and Senate Appropriation Committees Requested Biannual Report, January 1998, published on NHTSA’s web site; Martinez Interview, February 3, 1998; “Remarks Prepared for Delivery,” Secretary of Transportation Rodney E. Slater, Airbag Safety Campaign Press Conference, February 10, 1998. The campaign was renamed the Airbag and Seat Belt Safety Campaign at the press conference.

111. Insurance Institute for Highway Safety, “Child Restraint, Belt Laws as of August 2003,” accessed September 25, 2003 at www.highwaysafety.org/safety-facts; *Status Report*, September 25, 2003, p. 6; Derrig RA, Segui-Gomez M, Abtahi A, Liu LL, “The effect of population safety belt usage rates on motor vehicle-related fatalities”, *Accident Analysis and Prevention*, 2002; 34(1): 101-110.

112. Donna Glassbrenner, “Safety Belt Use in 2003,” Power Point presentation, August 20, 2003, National Center for Statistics and Analysis, National Highway Traffic Safety Administration, accessed September 26, 2003 at nhtsa.gov.

113. *Status Report*, January 2003, pp. 1-3.

- Recognize that airbags are just one part of the vehicle's occupant protection system; that no single combination of airbag characteristics is best for all vehicles; and that as a result, attempts to "rate" vehicle performance on selected airbag design characteristics are misleading.¹¹⁴

The first priority for improving occupant protection, according to the statement, should be to reduce harm to belted occupants and to children and others who are out of position. Protection for unbelted occupants should be improved only to the extent consistent with the first priority. But "[i]n no case should protection be diminished to any group as a result of rulemaking changes." The statement noted the currently available features of both airbag and seat belt technology that could help reduce airbag-related injuries as well as the new designs that were being tested. But it stressed that the most immediate gains in safety were attainable through behavioral changes — increasing use of occupant restraints, either seat belts or child seats, and placing children 12 and under in the rear seats.

In spite of the manufacturers' and IIHS' warning against arbitrary deadlines for advanced airbag definitions, Congress did direct the Department of Transportation to begin rulemaking that would:

improve occupant protection for occupants of different sizes, belted and unbelted, under Federal Motor Vehicle Safety Standard No. 208, while minimizing the risk to infants, children, and other occupants from injuries and deaths caused by airbags, by means that include advanced airbags...

no later than September 1, 1998, with a final rule to follow by March 1, 2000. This complex statement of purpose seemed to assign no particular priority to protecting belted or unbelted occupants or children. Advanced airbags were to be on all new vehicles by model year 2007.¹¹⁵

NHTSA issued a proposed rule on advanced airbags in mid-September 1998.¹¹⁶ The proposed standard was defined in terms of tests to be performed with an entire family of dummies representing children aged 1, 3, and 6 years, small (5th percentile) adult females, and average-size males. Previous airbag standards used only a median (50th percentile) male dummy. The rationale for using the new dummies was to promulgate standards that eliminated airbag harm to at-risk groups. A complex array of tests, with new criteria for chest and neck injury, was included.

Generally, automakers would have the options of suppressing the airbag if it put an occupant at risk or of demonstrating that the risk of injury in deployment would be low. Thus, for the 3 and 6 year-old dummies, there would be the options of showing that there would be no deployment if children were too close to the airbag or of passing a 30 mph barrier crash test with pre-impact braking. Testing of the small

114. American Automobile Manufacturers Association, Association of International Automobile Manufacturers, American Occupant Restraints Council, and Insurance Institute for Highway Safety, Joint Statement and Recommendations on Advanced Airbag Technology, March 1998.

115. Transportation Equity Act for the 21st Century, section 7103 (a). The law was signed June 9, 1998.

116. Department of Transportation National Highway Traffic Safety Administration 49 CFR Parts 571, 585, 587, and 595 [Docket No. NHTSA 98-4405; Notice 1] Federal Motor Vehicle Safety Standards; Occupant Crash Protection; Notice of proposed rulemaking. *Federal Register*, September 18, 1998, pp. 49958-50021.

female driver dummy would have to show that, if the dummy got too close to the airbag, deployment would be suppressed or the injury risk would be low. For the small female dummy, there would also be the option of simulating a low-speed crash with pre-impact braking. The small female would be tested in a 25 mph offset crash into a deformable barrier to test survivability in crashes into 'soft' or 'localized' objects. Finally, both the small female and median male dummies would have to survive a 30 mph barrier crash test, both belted and unbelted. The sled test alternative would be eliminated.

The new standard would be phased in between the 2003 and 2005 model years. Both a preliminary economic assessment and a technological assessment of advanced airbags by the Jet Propulsion Laboratory cited technological developments that might allow manufacturers to meet the proposed standards.

In spite of the complexity of the new test requirements and injury criteria, the most strenuous objections to the proposal from automakers and IIHS, as might be expected from prior statements, were to the elimination of the sled test and the restoration of the 30 mph unbelted crash test into a flat barrier.¹¹⁷ They feared that this would mean a return to higher powered airbags, which were the main source of the fatalities and serious injuries. The automakers also criticized the complexity of the standard, the new neck and chest injury criteria, and the assumption that technology under development in 1998 would be ready to meet the phase-in schedule. Some manufacturers objected to specific test standards, and IIHS noted the need for further research on the child and small female dummies. Automakers and the trade association of restraint manufacturers, AORC, complained about the large number of tests. AORC also argued "that to fully assess protection for belted and unbelted occupants, full vehicle barrier crash tests should be included." Although this was a mild difference from the manufacturers' position, AORC did not go so far as to specify a crash speed.

A major reason that NHTSA gave for replacing the 30 mph sled test was that it was unrealistic because it did not include the vehicle's entire structure. IIHS countered that the barrier tests were not more realistic, because they did not replicate either the forces that put occupants out of position or intrusion into the passenger compartment. IIHS urged NHTSA to consider a 35 mph unbelted offset test into a deformable barrier if the sled test had to be replaced. Toward the end of August 1999 the vehicle manufacturers recommended that the unbelted rigid barrier crash test for 50th percentile males and 5th percentile females should be at 25 mph. NHTSA and some safety advocates, including Public Citizen, the Center for Auto Safety, and Advocates for Highway and Auto Safety, feared that depowered airbags, tested only with belted dummies or in unbelted sled tests, would lead to increased harm to unbelted

117. Comments on the advanced airbag NPRM are accessible at the DMS search site of NHTSA's web site, in docket 98-4405. See especially, comments by the American Automobile Manufacturers Association, the Association of International Automobile Manufacturers, the Trilateral Working Group (of major Us, Japanese, and European automakers) Ford, General Motors, DaimlerChrysler, the National Safety Council, the Insurance Institute for Highway Safety, the National Transportation Safety Board, Advocates for Highway and Auto Safety, Public Citizen, and the Center for Auto Safety, as well as the transcript of the Advanced Airbag Rulemaking Public Meeting held by NHTSA on November 23 and 24, 1998.

occupants. However, there were no data showing this. In fact, IIHS argued that if unbelted occupants would be harmed by softer airbags, there ought to be evidence that some airbag-related fatalities were due to airbags bottoming out. IIHS and NHTSA disagreed about whether there were any such cases in the files. The National Transportation Safety Board deplored NHTSA's issuance of a proposed standard without a thorough evaluation of the experience of depowered air bags.¹¹⁸ Professor John Graham of the Harvard Center for Risk Analysis noted that NHTSA assumed that there was no risk that advanced airbags would malfunction.¹¹⁹ The proper cost-effectiveness comparison, he said, was between advanced airbags and depowered airbags. A wide alliance of parties — the American Automobile Association, the American Trauma Association, the National Safety Council, the National Association of Governors' Highway Safety Representatives, the National Automobile Dealers Association, and Professor Graham — joined the automobile trade associations, major insurers, and IIHS in a letter to Secretary Slater strongly opposing the 30 mph unbelted crash test into a flat barrier.¹²⁰

Although the Center for Auto Safety and Public Citizen supported the bulk of NHTSA's proposal, they did complain about the lack of a minimum deployment threshold — which they wanted set at 15 mph — because most children and small adults were killed by airbags when the bags deployed at low speed. They also called for a more complete family of dummies by adding a 95th percentile male and an elderly representative.

In the aftermath of the depowering rule, NHTSA had been accumulating data on trends in airbag power and on injuries that might be related to it. At the end of October 1999 it published a report that concluded:

Based on static and dynamic tests using adult and child dummies and the injury measures obtained in those tests, it is clear that airbags in recent MY 1998 and 1999 vehicles are less aggressive than the pre-MY 1998 airbags. As such, these airbags generally pose less of an injury risk to out-of-position occupants. The special crash investigations of real-world cases tend to confirm this general trend showing a significant reduction in fatality rates due to airbags in recent MY vehicles.¹²¹

Also, despite the depowering of airbags there was no statistically significant change in overall fatality rates; depowered airbags caused fewer injuries, but were no less effective than the earlier, more powerful airbags in saving lives.¹²²

118. NTSB also questioned the reinstatement of the higher unbelted crash test for 50th percentile males: "The Safety Board is concerned, however, that the new rule proposes test criteria that may not permit the development of air bags that are safe for all occupants, including children, elderly, and short-statured adults. The Safety Board suggests that the NHTSA consider whether a crash speed of less than 30 miles per hour into a full barrier or some other off-set crash test would provide the desired results of air bags that are safe for all occupants."

119. John Graham, Harvard Center for Risk Analysis, December 18, 1998, NHTSA docket, 98-4405-112.

120. NHTSA docket 99-4405-149.

121. John Hinch, et al., Office of Research and Development, National Highway Traffic Safety Administration, *Airbag Technology in Light Passenger Vehicles*, December 16, 1999, Revision 1, p. ES-3. This passage is unchanged from the October 26 report of which this title is a revision.

122. Department of Transportation, National Highway Traffic Safety Administration, [Docket No. NHTSA 99-6407; Notice 1] Federal Motor Vehicle Safety Standards; Occupant Crash Protection, *Federal Register*, November 5, 1999, p. 60562.

On August 3, 1999, nearly a year after the proposed rule on advanced airbags had been issued, Secretary of Transportation Slater wrote to the leaders of the congressional committees on transportation to tell them that the deadline for a final rule would be extended from September 1, 1999 to March 1, 2000, as was permitted by TEA-21.¹²³ Early in November 1999 NHTSA issued a supplemental notice of proposed rulemaking [SNPRM].¹²⁴ It dealt with the most contentious issue of the 30 mph barrier crash test by proposing alternative unbelted barrier tests: (1) a rigid barrier test with a minimum speed of 18 mph, going to a maximum that could be either 25 or 30 mph, with the possibility that the maximum speed would be phased in, or (2) a deformable barrier with a minimum speed of 22 mph and a maximum speed in the 30 to 35 mph range. The second alternative was developed in response to IIHS' recommendation.¹²⁵ If the 25 mph maximum speed in the first alternative was adopted permanently, NHTSA might also increase the belted rigid barrier test to 35 mph. Continuation of the sled test was definitely rejected. In response to manufacturers' complaints, the number of tests was significantly reduced. Live women and children might be used in tests to sense occupant presence. The agency also proposed new criteria for head injuries and dropped a proposed combined thoracic index. The SNPRM proposals for alternative barrier tests did nothing to moderate the disagreements over the issue of whether the 30 mph crash test into a rigid barrier should be reinstated.¹²⁶

The automakers, IIHS, the National Safety Council, and, eventually, the NTSB, all strongly supported the 25 mph crash into a rigid barrier. Public Citizen, the Center for Auto Safety, and Parents for Safer Air Bags argued that anything less than a reinstatement of the 30 mph rigid flat barrier test would not meet congressional goals of protecting both unbelted occupants and the small adults and children at risk from airbag deployment. If the former 30 mph crash test was responsible for air bag injuries, manufacturers should be recalling all vehicles that had that equipment. IIHS did further research that bolstered its position that ejections from the vehicle and intrusion into the passenger compartment, rather than too little airbag power, were the causes of deaths and injuries in moderate to severe crashes.

After the comment period was over, the opposing parties continued making their cases to Secretary Slater and to John Spotila, the head of the office charged with reviewing regulations for the White House Office of Management and Budget. Dr. Martinez had resigned as administrator of NHTSA before the SNPRM was issued. Brian O'Neill believes that the decision on the advanced air bag rule was not made within NHTSA, which was divided on the issue, but by the deputy secretary of transportation, Mortimer Downey.¹²⁷

123. Docket 98-4405-151.

124. See the entire document cited in note 119, pp. 60555-60629.

125. NHTSA acknowledged that IIHS subsequently withdrew its suggestion because of the danger that the test would lead to unintended increases in high energy deployments. *Ibid.* p. 60569.

126. See NHTSA Docket 99-6407.

127. Interview with Brian O'Neill, October 12, 2000.

On May 5, 2000, NHTSA issued its decision on the advanced airbag rule, not in the form of a final rule but as an “interim” final rule. The rule aimed to resolve the conflict between providing improved frontal crash protection to all occupants and reducing the harm that airbags caused, mainly to small women and children.¹²⁸ The maximum speed used for rigid barrier impact tests with unbelted dummies would be lowered from 30 to 25 mph; these tests would now be required for 5th percentile female dummies in addition to 50th percentile males. The oblique (30-degree) version of the unbelted barrier test would be required for male dummies only.

It was clear that the agency, or at least influential people within it, were choosing the lower crash speed with great reluctance. The “interim” nature of the decision was tied to NHTSA’s commitment to a multiyear data-gathering effort, including monitoring new vehicles to make sure that they were not just barely meeting the 25 mph test. A future “final” decision would reexamine the maximum unbelted barrier crash speed. NHTSA noted that if the 30 mph test speed had been reinstated, many of the changes in the new rule designed to reduce risk would not be possible. In addition, a 30 mph test speed represented a 44 percent increase in energy compared with a 25 mph test speed, and ensuring that airbags were powerful enough to protect unbelted dummies at 30 mph could result in more serious and fatal injuries. The agency also pointed out that most vehicles produced to meet the temporary sled test option, in place while the former 30 mph standard was under review, would, in fact, meet the 30 mph test.

Other new crash test requirements included belted crash tests for adult male and female driver and passenger dummies at 0-30 mph and a deformable offset barrier test with a belted 5th percentile female driver. To avoid airbags deploying inappropriately at low speeds, the perpendicular unbelted tests had a minimum speed for the first time: 20 mph. Dummies representing 5th percentile females and children 1, 3, and 6 years of age would be tested to ensure their safety when airbags inflated in low-speed crashes. The manufacturers could also choose to suppress the airbags if women and 3 and 6-year-old children moved out of position, suppressing them in all cases if a 1 year-old was present (possibly also in the presence of 3 and 6 year-olds). Beginning in model year 2008, to be phased in through 2010, the maximum speed for the belted rigid barrier test would increase to 35 mph for the 50th percentile male driver. All other aspects of the standard would be required in increasing percentages of new vehicles starting with the 2004 model year, reaching the full fleet by the 2007 model year.

In early January 2003 NHTSA reduced the percentage of new cars that would have to meet advanced airbag standards in the 2004 model year from 35 to 20 percent because of technical challenges caused by an insufficient availability of parts.¹²⁹

128. Department of Transportation National Highway Traffic Safety Administration [Docket No. NHTSA 00-7013; Notice 1] Federal Motor Vehicle Safety Standards; Occupant Crash Protection: ACTION: Final rule; interim final rule; *Federal Register*, Vol. 65, No. 93, Friday, May 12, 2000, pp. 30680-30770.

129. Department of Transportation National Highway Traffic Safety Administration [Docket No. NHTSA 02-14270; Notice 1] Federal Motor Vehicle Safety Standards; Occupant Crash Protection: ACTION: Final rule, *Federal Register*, Vol. 68, No. 21, pp. 4961-4965.

The long process that led to the development of regulatory standards for frontal airbags may be contrasted with the more recent effort to develop voluntary standards for side airbags. By the 1999 model year side airbags were standard on 45 vehicle models and optional on 11 more. Manufacturers were using widely varying technologies. Although there had been no fatalities or serious injuries reported from their use, NHTSA, Transport Canada, and General Motors said crash tests showed that children might be injured by side airbags.¹³⁰ NHTSA scheduled a public meeting to discuss the issue on April 19, 1999. A few days before, the Center for Auto Safety asked the agency to develop safety standards for side airbags. At the meeting the concerns about side airbags were balanced by crash tests showing their benefits and the lack of evidence of any serious injuries yet caused by them. A month later NHTSA head, Dr. Ricardo Martinez, asked the two major automobile trade organizations to propose a plan for developing standards for their members' side airbags. The automakers invited IIHS and the Automotive Occupant Restraints Council to join them in a technical working group chaired by Adrian Lund of IIHS. In August 2000, the group published its recommended procedures.¹³¹ A family of dummies representing out-of-position children, adolescents, and small adults would be tested to assess all regions of the body potentially at risk. Automobile manufacturers and their suppliers committed to use the guidelines in developing new side airbag systems. According to one press report, automakers would test all side airbags using these procedures by the 2004 model year.¹³² Some consumer groups, like Consumers Union and the Center for Auto Safety, criticized these voluntary standards because the government could not enforce them.

By the end of 2002 it was estimated that a third of new vehicles sold in the United States would have side airbags, mostly designed to protect the torso.¹³³ By the summer of 2003 there were enough side airbag-equipped cars involved in fatal accidents for IIHS to evaluate their effectiveness. It found that the risk of driver fatalities in driver-side collisions was reduced by 45 percent with head/torso side airbags and 11 percent by side airbags protecting the torso only.¹³⁴

Trends in Airbag Fatalities and Injuries

Airbag related fatalities peaked in 1997 at 53. In 1998, a year when most autos were sold with depowered airbags, fatalities declined slightly to 48, then to 24 in 1999, 18 in 2000, 9 in 2001, and 6 in 2002. The reduction appeared first among adults, but after only a year the reduction of deaths among children became as dramatic.¹³⁵ Depowered airbags, other changes in airbag design beginning with 1998

130. *Washington Post*, April 16, 1999.

131. "Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags," Prepared by The Side Airbag Out-of-Position Injury Technical Working Group (A joint project of Alliance, AIAM, AORC, and IIHS) Adrian K. Lund (IIHS), Chairman August 8, 2000; News Release: "Vehicle Safety Experts Submit Side Air Bag Test Procedures," August 8, 2000.

132. Auto.com, a Daily Publication of the *Detroit Free Press*, August 9, 2000.

133. *Automotive News*, cited in Elsa R. Braver and Sergey Y. Kyrychenko, "Efficacy of Side Airbags in Reducing Driver Deaths in Driver-Side Collisions," Insurance Institute for Highway Safety, August 2003.

134. *Ibid.*

135. DOT, NHTSA, Special Crash Investigation Report, "Air Bag Fatal and Serious Injury Report, October 1, 2003," accessed at nhtsa.gov.

models, and the growing use both of seat belts and child restraints as well as seating children in rear seats may account for the trend. Both for children and adults, fatal airbag injuries since 1998 occurred disproportionately in pre-1998 model year vehicles. Deaths related to sled certified (depowered) airbags were much lower than those related to barrier certified airbags, but each figure has declined since 1997.¹³⁶

In April 2003 there was a public meeting of a 'Blue Ribbon Panel' of automobile manufacturers, government and safety groups to evaluate the effect of depowered and advanced airbags since the 1998 model year. With the cooperation of NHTSA and funding by the auto industry, additional crash data were collected and several different statistical analyses were presented. The minutes summarized the presentations:

Overall we see that depowered airbags are doing a good job.... There has been no cataclysmic reduction in the effectiveness of airbags as some had predicted. Indeed, most of the statistical analyses that have been conducted to date indicate that there has been a small, but measurable, increase in effectiveness...

There is now a body of evidence that the depowered and advanced airbag systems have dramatically reduced the harm to out of position children and adults in low-speed crashes, which was an area of grave concern. Head, chest and abdominal injuries all seem to be down. There is some evidence, albeit very preliminary, that some body regions may be seeing an increase in injury. We will need to watch this very closely in an attempt to understand these data better and to confirm these early impressions. The data show that while the airbag appears to work very effectively when the collision forces are straight ahead, occupants can get around or over the airbag in many off center collisions.¹³⁷

Summary

The rapid spread of driver airbags in the early 1990s was propelled by consumer demand. Buyers were reacting to the glowing stories of crash survivors, and the product once opposed so fiercely by manufacturers was now being used as a competitive tool. The government's requirement for automatic occupant protection in cars, could be met temporarily with driver airbags and manual belts for front seat passengers. Manufacturers like Ford and Chrysler did not have sufficient staff to redesign all models with more than one kind of occupant restraint. So they reacted to buyers' apparent preference for airbags over automatic belts by making driver airbags standard as quickly as possible.

The popularity of driver airbags meant that there was little resistance to extending automatic occupant protection to light trucks. Then a 1991 law required airbags in all vehicles by 1998. The apparent success of driver airbags had converted Congress from its insistence on performance standards to a technology standard. There was little suspicion that the success of driver airbags might not apply equally to those on the passenger side.

136. *Status Report*, April 6, 2002, p. 7; John C. Kindelberger Augustus "Chip" B. Chidester Eric Ferguson, Air Bag Crash Investigations, National Highway Traffic Safety Administration, Paper No. 299, ESV 18, May 2003; DOT, NHTSA, Special Crash Investigation Reports, Normalized Tables, accessed in October 9, 2003 at nhtsa.gov.

137. The minutes of the April 4, 2003 public meeting of the Blue Ribbon Panel and the texts of all the presentations are at www.highwaysafety.org/presentations/brp/downloads, accessed on October 10, 2003.

Statistical studies confirmed the effectiveness of driver airbags in reducing deaths and serious injuries. Seat belt use, with or without airbags, was rising, but airbags were saving lives even when people were restrained. The first generation of driver airbags caused minor injuries in about half of deployments and a very few deaths in low to moderate speed crashes, especially to small women. The common denominator was that these victims were too close to the airbags, which were deploying with too much force, frequently in low speed crashes when they were not needed. Most often the occupants were not wearing seat belts and were forced out of position before deployment by sudden braking. The excessive force was due to test requirements that passive restraints be effective for unbelted as well as belted occupants.

Passenger deaths related to deployments of passenger airbags in low and moderate speed crashes rose in number through 1997. Practically all involved infants in rear-facing seats or unrestrained children in front seats. The latter is the classic case that so concerned automobile manufacturers in arguing against airbags. Ford said that having the driver airbag credit would give it time to deal with this issue before installing passenger airbags on a large scale. But the technological solutions were not available before driver credits ran out, and manufacturers were not so concerned that they kept passenger airbags off the market.

When reports about deaths and serious injuries caused by passenger airbags emerged, government, manufacturers, and many safety advocates stressed behavioral changes as the first line of defense: restraining children and infants in rear seats and making sure that all occupants used restraints to keep them in position. Lap/shoulder belts plus airbags were now viewed as the primary restraint system for adults and adolescents. Using belts and keeping children restrained in the back seat would optimize the effectiveness of airbags. Indeed, under these conditions, airbags would add to the effectiveness of belts even if they deployed with less power than required for unrestrained occupants.

Passenger airbags, according to the statistical studies, were saving hundreds of adult lives, and would save even more as they proliferated. But they were killing more children than they were saving. Although the public seemed overwhelmingly aware of the need to put children and babies in the rear seat and restrain them, enough forgot to do this — and enough adult drivers were at risk — so that other, more *passive* solutions were called for. NHTSA approved fairly quickly the solutions most easily implemented: depowering airbags and installing cutoff switches where rear seats were not present or usable, or where vehicle owners claimed to be in at-risk categories. Depowered airbags were available with the 1998 model year. Deaths due to air bags have declined since 1997, both among adults and children. Permission to install on-off switches came a little more slowly — it has been available since the beginning of 1998, but very few people have applied for it and even fewer have had the switches installed.

The concentration of media attention on infants and other children killed by passenger airbag deployments in low-speed crashes raised anxiety within the safety community, and among automakers and NHTSA, that the public or their representatives might insist on reversing airbag requirements. NHTSA's strategy for dealing with the issue of airbag fatalities and serious injuries, especially its

acceptance of depowering and of on-off switches, centered on maintaining and promoting consumer acceptance of airbags. This was also the aim of the Airbag Safety Campaign, which stressed the benefits of airbags, especially when used with the correct behaviors — always buckling up and putting children, properly restrained, in the rear seat. The entire safety community now agreed that the combination of passive airbags and active restraints was the optimal approach to occupant protection. These actions by both public and private interests, as well as the decline in airbag deaths after 1997, may explain why the media stopped focusing on airbag-related injuries and deaths.

Instead of reacting against airbags, Congress mandated technological solutions to airbag injuries and deaths on an accelerated basis. The safety community was unanimous in defending airbags and recommending that adults always use seat belts and restrain children in rear seats, but they were split over whether the advanced airbag standard should revert to a 30 mph crash test into a rigid barrier or stay with the sled test that permitted depowered airbags. IIHS, the National Safety Council, NTSB, and some medical groups joined forces with auto manufacturers to oppose a return to the higher speed rigid barrier test. Public Citizen, the Center for Auto Safety, and Parents for Safer Airbags forcefully lobbied on the other side. The decision was made to abandon the sled test in favor of a 25 mph rigid barrier test while further data were gathered. The standard was finally issued in May 2000, not nearly as rapidly as Congress had wished. Its complex provisions would not begin to take effect until September 2003. There was enough sympathy within NHTSA for reversion to the 30 mph rigid barrier crash test that the new 25 mph standard was labeled an “interim” rule.

Auto manufacturers and suppliers began to develop airbags to protect against serious injuries and deaths in side collisions largely because of the marketing power and effectiveness of frontal airbags. Side airbags spread rapidly without any regulatory mandate. When the first fears were expressed about the possibility of children being hurt when they deployed, NHTSA chose to ask the industry to develop voluntary procedures to protect against negative effects of side airbags, even in the absence of proven serious injuries. The procedures were developed in fewer than two years. Their rapid development obviously was inspired by the desire to avoid the deaths and injuries of infants and children that was a by-product of frontal airbags.

The years following the Dole decision witnessed a striking rise in seat belt use, partly because the decision led to the spread of seat belt use laws and to an initial decision by manufacturers to install automatic belts. By 1996 about two-thirds of drivers were using seat belts, although only half of car occupants involved in fatal crashes were restrained. In early 2003 79 percent of drivers and right front passengers were using seat belts. Occupants restrained by seat belts were much less likely to be seriously injured by airbags, and the evidence showed that airbags added to the effectiveness of seat belts. Undoubtedly, there would have been more fatal and serious injuries occasioned by airbag deployments if the use of seat belts had not risen to current levels.

Although virtually all members of the safety community have come to agree that the best restraint protection combines a *fastened* three-point seat belt with an airbag, there is still no federal regulation mandating the whole restraint system. Nor is there a requirement for the belt pretensioners and force limiters that are supposed to have increased both the effectiveness and integrity of the system. And, in contrast to the federal requirement for airbags in passenger vehicles, there is no federal requirement for the use of seat belts. The received wisdom is that this last would be a breach of states' rights. Secretary. Dole's decision did entice almost all states to pass some sort of belt use law, but usually with inadequate enforcement. The major transportation financing law passed by Congress in June 1998 provided financial incentives both for raising seat belt use rates and passing innovative safety laws, like those providing for primary enforcement of belt use laws. While the importance of primary enforcement laws has long been established by IIHS, this marks the first federal incentives to pass them. But, with all this effort, in October 2003 primary belt enforcement laws were in force in only 17 states and the District of Columbia.