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National Transportation Safety Board

Washington, D C 20594

Safety Recommendation

RE1

Date: JUL - 1 1997

In reply refer to: H-97-19 through -21

To the Domestic and International Automobile Manufacturers
(see attached mailing list)

In severe frontal crashes, air bags clearly increase the chances of survival, particularly for unbelted adult drivers, The protection afforded by air bags, however, does not extend equally to all passenger vehicle occupants. Between 1993 and 1996, 38 children died because they were struck by an air bag in what would have otherwise been a survivable crash, and **23** adults were also killed by their air bags in crashes they should have survived. The increasing public concern about air bags and urgent questions regarding the effectiveness and the potential danger of these life-saving devices prompted the National Transportation Safety Board to convene a 4-day public forum in March 1997 to discuss concerns related to the role of air bags, to identify who is vulnerable to injuries, to examine the experience with air bags in other countries, and to address ways to increase seatbelt and child restraint use.' The National Highway Traffic Safety Administration (NHTSA) participated in the forum, along with representatives from Australia, Canada and Europe; the automobile industry; air bag suppliers; insurance, safety, and consumer groups, and family members involved in crashes where air bags deployed.

Several points became evident during the forum The "one-size-fits all" approach to air bag design is obsolete: air bags need to be designed to protect *all* people in a variety of crash situations. With regard to passenger vehicles on the road today, children need to be in the back seat, and everyone needs to be buckled up and seated as far back as possible from the air bag. **NHTSA** needs to move quickly on a decision regarding air bag deactivation NHTSA's databases of crash information preclude a proper evaluation of the effectiveness of air bags because the information is not comprehensive in one database and the sample size is insufficient in the other. Finally and perhaps most importantly, societal attitudes must change with regard to seatbelt use The United States remains far behind other countries in seatbelt use, and the Nation pays a high price for it in terms of lives lost Elected officials need to take responsibility for tough enforcement programs and to consider financial incentives (or penalties) if the Nation is to increase seatbelt use,

[1] National Transportation Safety Board 1997. Proceedings of the National Transportation Safety Board public forum on air bags and child passenger safety; March 17-20, 1997; Washington, D C Report of Proceedings NTSB/RP-97/01; PB97-917001

The Safety Board's concerns about passenger vehicle occupant protection have led it to examine and recommend action on a wide range of safety issues throughout its 30-year history Important changes have already occurred, including improved designs of seatbelts and child restraint systems, the required installation of lap/shoulder belts at all outboard seating positions, the mandated use of child restraint systems in all *50* States and seatbelts in 49 States, an increase in public education about the importance of restraint use, and increased child restraint and seatbelt use rates Additional improvements, however, are still needed

Crash Discrimination/Deployment Threshold

Crash sensors in passenger vehicles today are much better at discriminating the crashes that need the protection of an air bag compared to the sensors in passenger vehicles a few years ago. Despite the improved sensors, however, the number of child and adult fatalities caused by air hags continues to be unacceptably high, Most of these fatalities occur in crashes that produce minimal injury to other occupants of the vehicle The evidence presented at the public fonim supports the need to increase the level of crash severity required to deploy the air bag. However, as often occurs in actual crash situations, there may be some tradeoffs associated with making that change.

Testimony at the public forum indicated that the deployment thresholds of most current vehicles are set for unbelted occupants. The threshold settings are based on preventing moderate facial bone fractures that could occur from an unbelted occupant contacting the steering wheel. Injuries of this type typically begin to occur at levels of crash severity equivalent to striking a rigid barrier at about 12 mph However, several manufacturers, notably Mercedes-Benz and BMW, have higher deployment thresholds for belted occupants than for unbelted occupants. They achieve this dual-stage threshold with single-point electronic crash sensors. The air bag energy level is the same for both belted and unbelted deployments. General Motors utilized electro-mechanical sensors for the dual-stage threshold system in the air bag-equipped 1973 Chevrolet and the air bag-equipped Buick, Oldsmobile, and Cadillac vehicles for model years 1974 through 1976; however, these dual-stage threshold sensors were utilized to determine the level of energy, **high** or low, for the passenger air bag. These were set to coincide with rigid frontal barrier crashes of 12 and 18 mph, respectively. Thus, dual-stage deployment threshold sensors, both the electronic and electro-mechanical types, have been proven to be viable for production vehicles.

Safety Board and NHTSA crash investigations and testimony at the public forum have demonstrated the viability and rationale for higher deployment threshold levels for a belted driver as well as for a belted occupant in the passenger-side seating position., Current research on force-limiting steering wheels, which can utilize both changes in design and materials, shows that a higher deployment threshold is also viable for an unbelted driver. Similar changes in design and material for the entire instrument panel would also allow a higher threshold for the passenger-side seating position. Higher thresholds are desirable to minimize the risk of air-bag induced injury to both belted and unbelted occupants, and are concurrently supported by biomechanics research along with a consensus of the safety community and general public.

In September 1996, as a result of its study on child occupant protection,[2] the Safety Board asked NHTSA to take the following action

> Evaluate the effect of higher deployment thresholds for passenger-side air bags in combination with the recommended changes in air bag performance certification testing, and then modify the deployment thresholds based on the findings of the evaluation (Safety Recommendation H-96-19)'

Safety Recommendation H-96-19 addressed only passenger-side air bags because the safety study on which it was based evaluated seating positions appropriate for children ages 12 and younger However, it was clear from the testimony at the public forum that consideration should also be given to increasing the deployment threshold of the driver-side air bag NHTSA's response of May 16, 1997, implies that it intends to address this issue through rulemaking; the Safety Board has encouraged NHTSA to address deployment thresholds for both driver and passenger-side air bags The Board believes, however, that the automobile industry could take an active role in the evaluation of higher deployment thresholds The automobile industry has a history of taking voluntary action to install improved safety features in passenger vehicles prior to NHTSA rulemaking Therefore, the Safety Board believes that the domestic and international automobile manufacturers should evaluate the effect of higher deployment thresholds for driver- and passenger-side air bags and then coordinate with NHTSA the modification of the deployment thresholds based on the findings of the evaluation

Estimating the Effectiveness of Air Bags

The benefits of air bags can be examined from different aspects. their effectiveness in reducing the risk of fatal injuries, their effectiveness in reducing the severity of nonfatal injuries, and the performance of various air bag technologies NHTSA uses data from its Fatality Analysis Reporting System *(FARS)* to estimate the reduction in fatality risk from air bags According to analyses based on FARS data, air bags reduce the overall fatality risk by 11 percent for drivers in passenger vehicles and by 13 5 percent for passengers over age 13 FARS data analyses also show that air bags increase fatality risk to children ages 0-12 and that air bags provide little protection for drivers over 70 years [4] NHTSA uses the National Automotive Sampling System (NASS) to evaluate the effectiveness of air hags in reducing the likelihood of sustaining a

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[2] National Transportation Safety Board 1996 The performance of child restraints, seatbelts, and air bags for children in passenger vehicles Safety Study NTSB/SS-96/01 Washington, D C

[3] Because of the importance of this issue, the Safety Board placed this recommendation on its "Most Wanted" list of safety improvements on May 20, 1997 The purpose of the "Most Wanted" list, which is drawn up from safety recommendations previously issued, is to bring special emphasis to the safety issues the Board deems most Critical

[4] National Highway Traffic Safety Administration 1996 Fatality reduction by air bags NHTSA Tech. Rep DOT HS 808 470 Washington, D C August

moderate or greater injury. The NASS analysis found that *air* bags combined with the lap/shoulder belt provide the greatest injury protection. The injury reducing effectiveness of the air bag alone was not significantly better than being unrestrained.'

In performing these analyses, NHTSA used "air bag-equipped'' as a surrogate for "air bag deployed," to estimate the effectiveness of air bags in reducing fatalities. These analyses did not determine whether or not the air bag actually deployed. Dr Charles Kahane of NHTSA stated at the public forum that NHTSA was interested in determining the number of lives saved or the total percentage reduction in the fatality risk given that the vehicle was equipped with an air bag, the designation "air bag-equipped" was thus an adequate substitute for "air bag deployed" in these analyses, Dr. Kahane added that with **FARS** data, analysts could not rely on the variable that indicates whether or not an air bag deployed Instead, he used the vehicle identification number (VIN) to determine whether or not a vehicle was equipped with an *air* bag and used this determination as the basis of the comparisons. Testimony by Dr. Lindsay Griffin, a research scientist from the Texas Transportation Institute, supported Kahane's method.

The Safety Board understands that using "air bag-equipped" as a surrogate for "air bag deployed" is an acceptable method for studies designed to assess the overall benefits of air hags in the passenger vehicles. However, with the advent of new air bag technology such as depowered air bags, cutoff switches, tag sensors, or other methods of deactivation, this crude method is not sufficient to measure the effectiveness of air bags. Assessments of the effectiveness of the various new air bag technologies will require a case-by-case collection of details regarding the installation and performance of the air bag and related systems such as cutoff switches, **tag** sensors, and other *air* bag technologies.

Timely evaluation of these new air hag technologies is essential. However, both Dr. Susan Ferguson, Vice President for Research at the Insurance Institute for Highway Safety, and Dr. John Graham, Director of the Harvard Center for Risk Analysis, stated in their testimony at the public forum that because of the quantity of data needed for a statistical analysis, such an analysis of the new air bag technologies will not be possible with the data collection techniques currently in place. Thus, analysis of the effectiveness of depowered air bags, cutoff switches, tag sensors, and other new air bag technologies will need to be based on comprehensive crash investigations. These data need to be collected in an expeditious manner.

A letter dated April **21,** 1997, from the American Automobile Manufacturers Association (AAMA) to the Safety Board's public docket on the forum indicated that it has met with **NHTSA** to discuss establishing a process by which to evaluate the benefits of new air bag technologies:

> Within 12 months of full implementation of depowered air bags, the safety effects of this new restraint system design can be quantified To this end AAMA's members will identify and advise NHTSA of each product introduced with depowered air bags. During this period of time, all FARS cases with a depowered

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'National Highway Traffic Safely **Administration** 1996 Effectiveness of occupant protection **systems** and their **use Third** Report to Congress Washington, D C **December**

system should get a "special in-depth" investigation These data are essential to determine the actual safety benefit assignable to depowering and to better understand where further improvements may he needed

The Safety Board agrees with the AAMA that a plan needs to be developed to evaluate the benefits of new air bag technologies and that this analysis should involve in-depth crash investigations The Safety Board believes that NHTSA and the automobile industry should develop and implement a comprehensive crash investigation program to evaluate the effectiveness of air bags This program should provide for long- and short-term evaluation of variations in air bag designs, advanced air bag technologies, and various methods to deactivate air bags

Electronic Recording of Crash Data

Since the early days of vehicle safety standards, government and industry have desired better data on the actual forces and acceleration levels in actual crash situations In the early 1970s, NHTSA sponsored research to develop and install crash recorders in vehicles in actual field service These electro-mechanical devices, crude by today's solid-state technology, **were** installed in a limited number of fleet vehicles Solid-state electronic accelerometers and data recording and readout devices have advanced substantially since the first NHTSA research in this area Indeed, such devices serve as the basis for many of the air bag sensor systems in use today and provide crash data readout parameters of value to NHTSA and industry researchers

The availability of accurate physical data that describe the forces and accelerations experienced in highway crashes is even more important today than it was in the 1970s Assessments of the effectiveness of air bags and other restraint systems in relation to measured crash pulses depend on instrumentation systems that can record these data On-board recording systems are technologically feasible and could be installed in passenger vehicles in much the same way that flight data recorders are used to capture relevant data from commercial airliners Thus, the Safety Board believes that the domestic and international automobile manufacturers, in conjunction with NHTSA, should develop and implement a plan to gather better information on crash pulses and other crash parameters in actual crashes, utilizing current or augmented crash sensing and recording devices

Therefore, the National Transportation Safety Board recommends that the domestic and international automobile manufacturers

Evaluate the effect of higher deployment thresholds for driver- and passenger-side air bags and then coordinate with the National Highway Traffic Safety Administration the modification of deployment thresholds based on the findings of the evaluation (H-97-19)

Develop and implement, in conjunction with the National Highway Traffic Safety Administration, a comprehensive crash investigation program to evaluate the effectiveness of air bags This program should provide far long- and short-term evaluation of variations in air bag designs, advanced air bag technologies, and various methods to deactivate air bags. 01-97-20)

Develop and implement, in conjunction with the National Highway Traffic Safety Administration, a plan to gather better information on crash pulses and other crash parameters in actual crashes, utilizing current or augmented crash sensing and recording devices (H-97-21)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility -- to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633) The Safety Board is vitally interested in any actions taken as a result of its safety recommendations and would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter Please refer to Safety Recommendations H-97-19 through -21 in your reply

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations

By: Jim Hall
Chairman

Automobile Manufacturers

Mr Victor Dollan
President
BMW of North America, Inc
300 Chestnut Ridge Road
Woodcliff Lake, New Jersey 07675

Mr Koichi Amemiya
President and Chief Executive Officer
American Honda Motor Co Inc
1919 Torrance Boulevard
Torrance, California 90510

Mr Y I Lee
President and Chief Executive Officer
Hyundai Motor America
10550 Talbert Avenue
Fountain Valley, California 92728

Mr Kazuo Akasaka
President
Isuzu Motors America, Inc
16323 Shoemaker Avenue
Cerritos, California 90703

Mr Hong Rae Park
President and Chief Executive Officer
KIA Motors America, Inc
2 Cromwell
Irvine, California 92619

Mr. Charles Hughes
President and Chief Executive Officer
Land Rover North America, Inc.
4390 Parliament Place
Lanham, Maryland 20706

Mr. Yoji Toyama
President
Mazda Motor of America, Inc
7755 Irvine Center Drive
Irvine, California 92718

Mr. Michael N Basserman
President and Chief Executive Officer
Mercedes-Benz of North America, Inc
One Mercedes Drive
Montvale, New Jersey 07645

Mr Tohei Takeuchi
President and Chief Executive Officer
Mitsubishi Motor Sales of America, Inc
6400 Katella Avenue
Cypress, California 90630

Mr Minoru Nakamura
President and Chief Executive Officer
Nissan North America, Inc.
18501 South Figueroa Street
Gardena, California 90248

Mr Frederick Schwab
President and Chief Executive Officer
Porsche Cars North America, Inc.
100 West Liberty Street
Reno, Nevada 89520

Mr William Kennedy, Sr.
Senior Vice President, General Counsel,
and Secretary
Rolls-Royce Motor Cars, Inc.
140 E Ridgewood Avenue
5th Floor N Tower
Paramus, New Jersey 07652

Mr. George Muller
President and Chief Operating Officer
Subaru of America, Inc.
Subaru Plaza
2235 Route 70 West
Cherry Hill, New Jersey 08002

Mr. Masao Nagura
President
American **Suzuki** Motor Corporation
3251 East Imperial Highway
Brea, California 92821

Mr Yosio Ishizaka
President and Chief Executive Officer
Toyota Motor Sales, USA, Inc
19001 South Western Avenue
Torrance, California 90509

Mr Clive B Warrilow
President and Chief Executive Officer
Volkswagen of America, Inc
3800 Hamlin Road
Auburn Hills, Michigan 48326

Mr Albert R Dowden
President and Chief Executive Officer
Volvo North America Corporation
535 Madison Avenue
New York, New York 10022

Mr Jean-Phillipe Fournier
President
Peugeot Motors of America, Inc
One Peugeot Plaza
Lyndhurst, New Jersey 07071

Mr Joel Manby
Chief Operating Officer
Saab Cars USA, Inc
4405-A Saab Drive
Norcross, Georgia 30093

Mr. Robert J Eaton
Chairman and Chief Executive Officer
Chrysler Corporation
12000 Chrysler Drive
(CJMS 416-19-210)
Highland Park, Michigan 48288-0001

Mr Alexander Trotman
Chairman, President, and Chief Executive Officer
Ford Motor Company
World Headquarters
Post Office Box 1899
Orlando, Florida 32809

Mr John F Smith, Jr
President and Chief Executive Officer
General Motors Corporation
14-130 General Motors Building
3044 West Grand Boulevard
Detroit, Michigan 48202

Mr Ricardo Brognoli
Vice President and Chief Operating Officer
Alfa Romeo, Inc
6220 South Orange Blossom Trail
Suite 606
Orlando, Florida 32809

Mr Michael Dale
President
Jaguar North America
555 McArthur Boulevard
Mahwah, New Jersey 07430-2327