Report of the First Public Meeting of the Blue Ribbon Panel for Evaluation of Depowered and Advanced Airbags

The Blue Ribbon Panel (BRP) for Evaluation of Depowered and Advanced Airbags held its first public meeting at the Ronald Reagan Building and International Trade Center in Washington D.C. on April 4, 2003. The following is a brief summary of the individual presentations that were made and an overall summary of the day's activities as summarized by the BRP Chairperson, Dr. Susan Ferguson, at the conclusion of the meeting. The complete presentations can be downloaded from the BRP website: http://www.highwaysafety.org/presentations/brp/.

After welcoming all attendees, Dr. Susan Ferguson made an introductory presentation that described the genesis of the BRP, its composition, major decisions to date, and the status of BRP data collection and analysis activities. Dr. Ferguson described a letter dated 2-16-00, to then Department of Transportation Secretary Slater from six highway safety organizations, expressing concern about a return to the 30-mph rigid barrier test using unbelted dummies previously required by FMVSS 208. The letter requested the National Highway Traffic Safety Administration (NHTSA) to expedite data collection of the real-world crash experience of airbag-equipped vehicles certified to the 30 mph "sled test" using unbelted dummies. It also asked the auto industry to commit funding for additional data collection and to establish a panel of experts to evaluate the data. In response, the Alliance of Automobile Manufacturers committed to funding a 3-year program to be managed by an independent third party. A panel of experts consisting of representatives from the highway safety research community, the National Transportation Safety Board, academia, medical institutions, and the insurance industry was established as the Blue Ribbon Panel for Evaluation of Depowered and Advanced Airbags, which met for the first time in February 2001. The BRP also includes representatives from NHTSA and the automobile industry who participate as observers.

In this first meeting, the BRP agreed that the goals of the BRP effort are to answer three basic questions:

1) Are vehicles equipped with redesigned and advanced airbag systems as effective as vehicles equipped with first-generation airbags at reducing overall injury and death in frontal crashes?
2) Are vehicles equipped with sled-certified airbag systems offering reduced protection in higher-severity crashes, particularly for unbelted occupants?
3) Is the incidence of airbag-induced injuries to children and other vulnerable occupants lower in vehicles with redesigned airbags, particularly in low-speed frontal impacts?

After studying eight possible approaches for data collection, the BRP decided to utilize the existing NASS/CDS infrastructure by adding three new data collection teams. The panel agreed that the Alliance-funded study should gather a probability-based sample of frontal crashes of all severity levels involving vehicles of the current model-year and the four prior model years, but to over sample higher severity crashes. Data from this study will be incorporated with the existing NASS data and can be weighted to estimate national crash rates. The crash data collected will be fully compatible with the current NASS/CDS cases, thus enhancing the ability to use the total file for statistical analysis. The BRP agreed that both statistical and anecdotal analyses of crashes would need to be performed to facilitate informed public policy decision making and to allow the vehicle manufacturers to make evolutionary refinements to airbag systems.

Three new NASS sites were selected, investigators were hired and training beginning in October of 2001. Full case collection commenced April 2002. Dr. Ferguson concluded her presentation by showing the URL for the web site that has been established by the BRP. She noted that the site contains minutes of all the meetings of the BRP and all presentations made to and by BRP Panel Members. She also noted that this meeting was the first in a series of yearly public meetings to present and discuss progress toward achieving the goals of the BRP program.

Following her presentation, Dr. Ferguson introduced Chip Chidester, Chief of the Crash Investigation Division of NHTSA's, National Center for Statistics and Analysis. Chip's presentation was entitled: "Evolution of Air Bag Technology – Including a Discussion EDR Importance". Chip led off with a brief discussion of recent changes to FMVSS 208. Principal changes include the March 1997 rulemaking action which allowed manufacturers to depower their airbags by certifying unbelted dummy performance using a

30-mph sled test, and the May 2000 final rule that requires manufacturers to certify occupant protection for a wider range of occupant sizes and positions over a wider range of test conditions.

Mr. Chidester went on to describe the difficult issues associated with airbag performance over a wide range of crash circumstances, occupant sizes, and occupant positions. He provided a glimpse of some of the advanced technologies, such as infrared and sonic sensors, that likely will be used in advanced airbag systems. The heart of these advanced systems is the Electronic Control Unit (ECU), which must process all the input from the various sensors and make the critical deployment decisions. An integral part of the ECU is the Event Data Recorder (EDR), which for some vehicles preserves an array of pre-crash and crash data for later retrieval. Mr. Chidester indicated that readout of the EDR by crash investigators would be critical to the successful analysis of airbag system performance. For example, in the case of airbag systems with multiple stages of deployment, it will not be possible to know what stages deployed without the EDR readout. Mr. Chidester said that a cooperative effort between NHTSA and the automobile industry is producing fruitful results in terms of crash investigators downloading and interpreting EDR data. He also discussed advances in seat belt technology such as pretensioners and belt force limiters, and concluded this presentation by describing how NHTSA's Advanced Occupant Protection System Study (AOPSS) is gathering data to assess the "real-world" performance of vehicles equipped with advanced occupant protection systems.

Mr. Chidester remained at the podium for a second presentation entitled: "Special Crash Investigations and National Automotive Sampling System CDS, and Alliance Air Bag Data Collection." He described the two objectives of NHTSA's frontal airbag data-collection program: 1) airbag related injuries and 2) assessing the safety impact of new and/or emerging occupant protection system technologies. He first described the Special Crash Investigations (SCI) program; SCI cases are published quarterly on the NHTSA website. Bar charts were presented of airbag-related adult and child fatalities in low speed crashes normalized by million-registered vehicle years. Deaths peaked in the 1995-1997 timeframe with a steady decline thereafter. Mr. Chidester attributed this decline to changes both in airbag system design and the success of the public information campaign, which has advised motorists not to place children in the front seat. The campaign also has emphasized the importance of adults using seat belts and sitting a safe distance from the airbag module. The next set of bar charts showed the same normalized fatalities by vehicles equipped with sled-certified airbag systems versus those that were barrier-certified with unbelted dummies. For the adults, the results are mixed; in some calendar years, fatalities for sled-certified systems were lower, while for other calendar years, fatalities for the barrier-certified systems were lower. Child fatalities for the sled-certified systems were lower in all calendar-year groupings.

Mr. Chidester reported that the SCI program has not investigated a single fatal or life-threatening injury related to the deployment of an advanced airbag certified to the test requirements that will be in effect in September of 2003. He next described the Redesigned Air Bag Special Study (RABSS), which is being conducted using both SCI and NASS data. Part of this study involved a review of more than 400 cases involving redesigned airbags. The engineers made judgments about whether occupants were out of position at the time the airbag deployed, whether occupant interaction with the steering wheel or instrument panel was subsequent to airbag loading, whether the crash was survivable, and the sources of primary injuries. Preliminary findings (a paper has yet to be published) suggest that occupants were more likely to sustain fatal or serious injury if there was steering-wheel rim/column deformation. There was also evidence that the extent of steering-wheel rim deformation and the severity of injuries were related to occupant weight; the mean weight of occupants sustaining fatal injuries with steering-wheel rim contact was 262 pounds, versus 178 pounds for those who did not die, even though the crash severities were approximately the same for the two data sets.

Finally, Mr. Chidester described the status of data collection within the three new Alliance-funded NASS PSU's and the original NASS/CDS. Anecdotal data collection began at the new PSU's on January 1, 2002 and full case investigations began April 1, 2002. There are currently 1047 NASS CDS cases meeting the criteria for analysis of airbag performance and, of these, 341 are Alliance team cases for calendar year 2002. The Alliance-funded cases are thus making a significant contribution to the overall number of cases available for analysis of airbag effectiveness. All cases are available for viewing on the NHTSA web site: http://www-NASS.nhtsa.dot.gov/BIN/NASSCASELIST.EXE/SETFILTER. At the behest of the BRP, NHTSA now is making preliminary NASS cases available on the web on a quarterly basis. Thus, analysts no longer need to wait for the NASS SAS file, which is normally released once a year in July.

Dr. Ferguson introduced Dr. Larry Schneider from the University of Michigan Transportation Research Institute (UMTRI). Dr. Schneider's presentation was entitled: "Comparison of Frontal-Crash Protection for Front-Seat Occupants in "Pre-1998" and "1998+" Model-Year Vehicles." Dr. Schneider described an in-depth crash investigation program that has been on going at the University of Michigan for 35 years with sponsorship from the Alliance and its predecessor organizations. The investigations focus on moderate to severe crashes involving late-model vehicles. The database resulting from crashes investigated since 1990 has been used to conduct both anecdotal and statistical analyses and comparisons of the frontal crash protection provided by pre-1998 and 1998 and newer model vehicles. The analyses are attempting to answer two key questions: Is there a reduction in airbag-induced injuries and fatalities? And, is there any change in frontal crash protection? The data set consists of 318 pre-1998 case vehicles and 249 1998and newer vehicles for which good estimates of crash severity using vehicle crush measurements are available, and for which there were no other significant crash or rollover events that may have produced injuries to the occupants of the case vehicle.

Dr. Schneider described a number of example cases that are considered "success stories" wherein airbag systems in 1998 and newer model vehicles provided good protection for both belted and unbelted front-seat occupants. He then showed two cases where it appears that the occupant may have overpowered the airbag, resulting in serious or fatal chest injuries. These cases were described as being rare in occurrence. Such cases were not limited to depowered airbags but also had been seen in pre-1998 vehicles. Next, he showed several "partial success" cases wherein the occupant went around and/or over the airbag. These cases were described as more common than the overpowering cases and usually the occupant was provided considerable protection by the airbag prior to sustaining head, face, and neck injuries from contact with the vehicle interior after getting over or around the airbag. Finally, he showed two cases of airbag-induced fatalities in relatively minor frontal crashes; one involving an adult and the other a seven-year old child. Both fatalities resulted from the airbag "flinging" the occupant into the vehicle interior causing severe head and brain injuries.

Dr. Schneider described two types of statistical analyses that have been performed on the data sets: 1) comparison of variable distributions and 2) multiple logistical regression models. The distribution comparisons for all drivers show that distributions of crash, vehicle, occupant, and restraint variables in the pre-1998 and 1998 and newer model vehicles match extremely well except for vehicle type and mass. Although the distributions of vehicle type and vehicle mass show higher percentages of heavier SUVs and pickup trucks in the 1998 and newer vehicle data set, the distributions of crash severity for the two data sets are nearly identical.

Dr. Schneider then showed comparisons of distributions of maximum injury severities (i.e., MAIS) for different body regions and various combinations of body regions for all drivers in the pre-1998 and 1998 and newer model vehicle data sets. The injury distributions for the two groups were not statistically significantly different, although drivers in the pre-1998 vehicles sustained marginally greater frequencies of severe neck injuries. Most importantly, the distributions of the maximum injury severity (MAIS) for the five body regions that belt and airbag restraint systems are designed to protect, namely, the head, neck, face, chest, and abdomen, are nearly identical for the pre-1998 and 1998and newer vehicles.

Dr. Schneider proceeded to show similar comparisons of independent and dependent (MAIS) variable distributions for unbelted drivers. The results are similar to results for all drivers. That is the independent variables, with the exception of vehicle type and mass, were very well matched for the two groups. Again, the distributions of MAIS for the combined regions of head, face, neck, chest, and abdomen are nearly identical, although the data for unbelted drivers of the pre-1998 vehicles show somewhat higher percentages of drivers with severe neck and chest injuries. Interestingly, the injury data for unbelted drivers of 1998 and newer vehicles show higher frequencies of serious forearm, elbow, wrist, and hand injuries and higher frequencies of moderate-to-serious knee, thigh, and hip injuries that are marginally significant.

Multivariate analysis of these data shows that the best predictors of serious injuries to drivers in frontal crashes of airbag-equipped vehicles are crash severity, seat belt use, and driver age. Logistical regression models developed separately for the two sets of data show that unbelted drivers are much more likely to sustain serious injuries to the head, face, neck, chest, and abdomen in frontal crashes than are seat belted drivers, and that the probability of a driver sustaining an MAIS≥3 injury to these body regions at any crash severity is greater for the pre-1998 vehicles compared to the 1998 and newer vehicles. Although these differences are not statistically significant, this relationship of the injury-probability curves is consistent across all driver ages and for both belted and unbelted drivers. The regression models also indicate that

differences in injury probability curves for the two model-year data sets are largest for unbelted drivers compared to belted drivers, suggesting that later-model airbag-equipped vehicles are offering better protection to the head, face, neck, chest, and abdomen of unbelted drivers than are earlier-model airbag-equipped vehicles. Also, the probability of sustaining an MAIS≥3 injury increases when the upper and lower extremities are included in the models, and the probability curves for the two data sets become nearly identical.

Dr. Schneider concluded with the following observations: 1) 1998 and later model-year vehicles are at least as effective as pre-1998 model-year vehicles in protecting the head, neck, chest, face and abdomen of belt-restrained and unbelted occupants in moderate-to-severe frontal crashes; 2) the concern about sled-certified occupant-protection systems offering less protection (than vehicles with first generation airbag systems) to unbelted occupants in moderate-to-severe frontal crashes is not supported by the UMTRI frontal-crash database; 3) airbags in 1998 and newer model vehicles are less injurious than airbags in pre-1998 vehicles but still cause abrasions and contusions and are capable of causing fatal head, neck and chest injuries to children and adults who are in close proximity to the airbag module at the time of deployment; 4) disabling injuries to the lower extremities continue to be a problem in moderate to severe frontal crashes, even for occupants restrained by seat belts and airbags; and 5) fractures to the thigh and hip appear to be occurring at a greater rate in 1998 and newer model vehicles than in pre-1998 vehicles, particularly for unbelted occupants.

****

Dr. Ferguson introduced Maria Segui-Gomez, M.D., ScD from John Hopkins University and Universidad de Navarra. Dr. Segui-Gomez's presentation was entitled: "Changes in Injury Patterns in Frontal Crashes: Injuries to Drivers of Vehicles Model Year 1993-1997 vs. Drivers of Vehicles 1998-2002".

Dr. Segui-Gomez used bivariate and multiple logistical regression analyses to evaluate whether there have been any detectable changes in the frequency and severity of injuries to drivers of 1998 and newer model year vehicles and if so, whether those changes were related to differences in driver, vehicle, or crash characteristics, including airbag deployment. The cross sectional study design used NASS/CDS data from years 1993-2001.

The bivariate analyses showed that there were no differences in gender distribution, age distribution, and crash severity distribution in MY 1998-2002 vehicles as compared to MY 1993-1997 vehicles. However, MY 1998-2002 vehicles were more likely to be SUVs or minivans, have higher drivers seat belt use rates, have lower airbag deployment rates, and their drivers sustained fewer injuries.

The logistical regression analyses showed that the driver MAIS was a function of whether they were in a pre- or 1998 and newer vehicle, longitudinal delta V, seat belt use, vehicle type, gender and age. The percent of crashes with airbag deployment was significantly lower for the 1998 and newer vehicles across all crash severity levels.

Dr. Segui-Gomez concluded that drivers in frontal crashes of known severity in vehicles in model year 1998-02 sustain significantly fewer and less severe injuries than their counterparts in MY pre-1998 vehicles. This is true for all drivers, males, females, MAIS 2+, 3+, and across crash severity, however, it does not hold true if one evaluates airbag deployment.

Dr. Ferguson introduced Dennis Durbin, M.D. with Partners for Child Passenger Safety (PCPS) at The Children's Hospital of Philadelphia, the University of Pennsylvania. Dr. Durbin's presentation was entitled: "Performance of Second Generation Air Bags for Child Occupants". The objective of this study was to estimate the exposure of children to passenger airbag deployment and assess the risk of injury of first (pre-1998) versus second (1998 and newer) generation airbag systems for child occupants. The PCPS project and study is sponsored by State Farm Insurance Company and uses both telephone interview data and in-depth crash investigation.

Fewer children in all age groups through the age of 14 sit in the front seat of airbag-equipped vehicles compared to those without passenger airbags. However, the exposure of children to airbags is still increasing since the number of passenger airbag-equipped vehicles on the road is increasing dramatically.

Injury analyses were conducted to compare risk of injury to restrained children 3-15 years old exposed to a passenger airbag versus those in driver airbag only vehicles. Exposure to a passenger airbag was concluded to increase the risk of minor and significant injury for a mix of both first and second-generation airbags. Subsequent analyses focused on how the risk of injury may have changed for second-generation airbags.

Deployment rates dropped significantly for second-generation (1998 model year and newer) airbags (10% vs. 5.5%). The overall minor injury rate was about the same for first and second-generation airbags but the injury rate for significant injuries dropped markedly for the second-generation airbags for all age groups. The injury reduction was the most dramatic in the younger age group (3-8 years).

Dr. Durbin discussed several regulatory issues that needed to be addressed for children. Head injuries seem to be more prevalent in children compared to adults and little work has been done to assess the relevance of the Head Injury Criterion (HIC) for children and the prevention of concussion. The current dummies are also not capable of measuring the propensity for facial injury and upper extremity injury

Educational issues that need still to be addressed include: the prevalence of older children who sit in the front seat (one-third of 9-12 year olds still sit in this seating position); older airbag-equipped vehicles now are being driven by subsequent owners in different socio-economic subgroups that may not be as aware of the importance of placing children in the rear seat of airbag-equipped vehicles; and, new designs may carry conflicting messages for consumers (if automobile manufacturers tote the life saving advantages of new designs and studies show the reduction in injury for new designs, caregivers may think it is now alright to put their children in the front seat). For this reason maintenance of the rear-seating message is crucial.

Future work of the PCPS project will focus on the injury reduction in second generation airbags by vehicle type, and the effect of the individual design changes in advanced airbags, i.e., dual stage inflators, and the role of the airbag in injury causation.

Dr. Ferguson introduced Jeffrey Augenstein, M.D., Director of the William Lehman Injury Research Center at the University of Miami. Dr. Augenstein described the crash studies that have been conducted at the Research Center for a number of years. The Ryder Trauma Center is a Level I trauma center and as such treats only the most severely injured occupants of vehicle crashes as well as other severe cases of trauma. The center investigates very severe crashes through funding provided by the Alliance of Automobile Manufacturers and the DOT sponsored Crash Injury Research and Engineering Network (CIREN) program.

Dr. Augenstein is very concerned about the chilling effect that the recently enacted HIPPA legislation will have on crash research. Their crash investigators already have encountered problems in getting the medical records of crash victims from some of the local hospitals. Dr. Augenstein expects that the situation will worsen appreciably when the legislation becomes effective. Later on in the program, Dr. Carra agreed with Dr. Augenstein's concerns. Dr. Carra noted that HIPPA legislation was enacted to protect the privacy of medical records but was having the unintended consequence of creating a chilling effect on the willingness of hospitals to provide crash victims' medical info to NASS/CDS researchers. Even though they assure them that the privacy of the individuals will be protected and the information will be used only for research purposes. He noted that NHTSA has been attempting for almost two years to get a statement of some kind from the Office of Civil Rights of the U.S. Department of HHS that would recognize that NHTSA is engaged in research as a U.S. public health agency and therefore cooperating hospitals need not be concerned. Facing the prospect of more hospitals deciding no longer to cooperate, NHTSA issued a Federal Regulatory notice and a letter from the Administrator making the declaration that NHTSA is a U.S. public health authority.

Dr. Augenstein introduced Dr. Kennerly Digges, Director of Biomechanics and Safety Research, FHWA/NHTSA National Crash Analysis Center, to present findings from crash research at the Lehman Center. Dr. Digges' presentation was entitled: "Performance of Advanced Air Bags Based on Data from William Lehman Injury Research Center and New NASS PSU's ". Dr. Digges began by showing a number of charts that described the attributes of the NASS/CDS cases by crash and injury severity. He concluded by showing that MAIS 3 and higher nonfatal and fatal injuries comprise approximately 2% of the total NASS cases. For the Ryder trauma center cases, 50% are MAIS 3+ and 25% are fatal. Dr. Digges surmised that if the MAIS 3+ fatal and nonfatal injuries were considered as "failures" and the remaining 98% with MAIS 2

or less as successes, this could be equated to the 75% failure rate (MAIS 3+ and fatal) in the trauma center cases for analysis purposes.

The total database of frontal cases with no rollover consists of 147 drivers with first generation airbags and 58 cases with second-generation airbags. Dr. Digges showed a chart of fatality rate by delta V for first generation airbags and noted that the rate was higher than expected at the lower delta V's. There were 9 fatalities at a delta V of less than 20 mph (4 to short stature occupants, 4 to older occupants and 1 due to intrusion/incompatibility). He concluded that first generation airbags were too stiff for occupants in close proximity to the deploying airbag and too stiff for older persons. For the second generation airbags there were no fatalities below 25 mph. Dr. Digges calculated the fatality rate for crashes above 40 mph and showed that it also was considerably lower for the second-generation airbags. Dr. Digges made the following overall observations for second generation airbags: early deficiencies at low speed has been greatly reduced; belt systems improved to reduce chest loading; steering column and airbag work well together to provide high severity protection; late deployments can still cause chest injury in moderate severity crashes; and, softer airbags may provide reduced protection in offset and angular crashes at intermediate severities.

Dr. Digges then showcased 6 crashes; 3 to illustrate residual injuries and 3 to illustrate high severity performance. The reader is referred to the presentation slides for details of injuries and observations for the individual cases.

Dr. Digges showed the number of cases and the fatality rate for first and second-generation passenger airbags. There were 4 fatalities at delta Vs of less than 20 mph with first generation airbags (2 infants in rear facing child seats, 2 unbelted children under 3 years old and 1 unexpected fatality at moderate severity to an out of position adult). The observations for second generation passenger airbags were: no child fatalities; no close-in fatalities; no elderly fatalities below 30 mph delta V; 8% higher overall fatality rate and no success stories above 30 mph; early deficiencies at low speed have been greatly reduced; belt systems improved to reduce chest loading; no steering column to provide high speed protection; and, preliminary results suggest softer airbags may reduce protection for unrestrained in high severity crashes. Dr. Digges then showed 2 example cases of high-speed protection -- one in which a passenger died and one in which the passenger survived.

Dr. Digges showed NASS/CDS cases illustrating protection of elderly occupants in a severe crash, one involving a rear-facing child restraint and success stories. NASS/CDS cases illustrating benefit of steering column energy absorption in intermediate to severe crashes were also shown.

Dr. Digges closed by noting that the data presented is primarily based on depowered airbags. It still is not possible to tell from these data whether airbags designed to the new 208 standard will be less protective at higher speeds for unrestrained occupants.

Dr. Ferguson returned to the podium and thanked all the speakers for excellent presentations and thanked the Alliance for providing such a splendid facility for the BRP Public Meeting. She then summarized the day's activities as follows:

As a result of the additional resources committed by the Alliance, we are now collecting NASS/CDS cases at a much faster pace. For 2002, the existing NASS/CDS PSUs collected 1047 frontal cases (without rollover) appropriate for analysis of airbag performance. The Alliance funded PSUs added an additional 341 cases for an increase of 33% in available cases.

Overall we see that depowered airbags are doing a good job, as shown in the NASS/CDS data, SCI data at both UMTRI and WLIRC, CIREN data and CHOP data. 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. The FARS analysis in NHTSA's 5/6th Report to Congress indicates that effectiveness increased about 1%. During its initial deliberations on the type and quantity of data needed to answer questions about changes in overall airbag effectiveness, the BRP performed "power analyses" (estimates of the quantity of data required to produce statistically significant results, assuming certain levels of change in airbag effectiveness). These analyses showed that we could detect wholesale changes in effectiveness (on the order of 20%) with one

year using NASS/CDS data. Thus, the BRP is confident that we would have seen evidence of such a decline had it occurred, even at this early stage of data collection.

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.

The data has been reviewed from a statistical standpoint and also anecdotally on an individual case basis. The BRP has believed from the outset that both types of analysis are critical to understanding how to improve the performance of airbag systems. Statistical analyses will tell us the overall long-term efficacy of regulatory changes and the manufacturers' response thereto. However, it will be many years before we can understand the effect of individual technologies, such as new arrays of crash sensors, thus we will need to continue with case-by-case anecdotal analyses to give us an early readout of how these technologies are performing in particular crashes.

EDRs will be important tools in helping crash investigators to understand the nuances of advanced airbag system performance. For example, without EDR readout it will likely not be possible to determine which stages deployed in multi-stage inflators. Fortunately, we have heard today that great progress has been made in joint industry/government programs to get crash investigators the tools they need to read and interpret EDR recordings where this information is available.

As researchers, our perennial lament is that we do not have enough data. Good news is that more data are coming and at a faster rate than ever before. We look forward to analyzing new data as it becomes available. We will reconvene about a year from now to reconsider what we are finding.

I have to publicly thank our NHTSA observers, Dr. Carra and Chip Chidester, for all that they have done. NASS/CDS crash investigation data is now available on the Web on a quarterly basis and programmatic changes have been made to facilitate real time analyses. This will permit earlier access to this important data by analysts.