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Frontal Crash Protection Team

Briefing June 2008

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Overview

- **Team Makeup**
- **Team Goals**
- **Summary of Findings**



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Objective

- **Frontal Crash Team appointed in late 2007 by Senior Administration**
- **Team tasked with examining the frontal crash issue**
 - **Collectively many things have been done to improve frontal occupant protection**
 - **Why are there still numerous frontal fatalities?**
- **What should the Agency be looking at down the road?**



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Overview

- **Team members:**
 - **John Brophy (Chair) - NVS-411**
 - **Charlie Case - NVS- 200**
 - **Chou-Lin Chen - NVS-421**
 - **Harold Herrera - NVS- 411**
 - **John Hinch - NVS- 330**
 - **Chuck Kahane - NVS-431**
 - **Greg Radja - NVS-411**
 - **Lori Summers - 100**
 - **Shirong Wei – NVS- 200**
- **Other staff members of various offices participated as needed**



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Background

- **Air bags evolved over the last 35 years**
- **In 1996 manufacturers were required to install air bags in any motor vehicle**
- **Air bags and manual belts were consumer preference and most effective system**
 - **Automatic belts were phased out**
- **First generation air bags (pre 1997) designed to deploy in one manner to intercept unrestrained front occupants**



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Background

- **Due to unintended consequences with child safety seats Rulemaking actions were undertaken**
 - **Consumer Advisory (1991); Warning labels (1993); OEM On-Off switch for certain vehicles (1995)**
- **Expanded to include children and small stature adults:**
 - **Consumer Advisory (1995); Warning labels (1996);**



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Background

- **In response to real world problems NHTSA took action to provide an immediate and interim solution:**
 - **Depowered Rulemaking (1997)**
 - **Some manufacturers installed bags that were 20-35% less powerful**
 - **Passenger bag volume was reduced an average of 26%**
 - **Almost 90% of bags post 1998 had two or more tethers**
- **Aftermarket on-off switches (1997)**



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Background

- **Advanced air bag rule - May 12, 2000**
 - **Flexibility options for manufacturers**
 - **Suppression (children); low-risk deployment (low level of force), or dynamic auto suppression (too close to air bag)**
 - **FMVSS 208 was amended 8/06 to establish same 35mph crash test using belted 5th percentile female dummy (50th % male dummy in previous tests)**



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Frontal Fatality Reductions

- **Seat belt and Air bag fatality reductions:**
 - **The average fatality reduction by seat belt use in all frontal crashes – given the calendar year 2005 mix of occupants, vehicles and crashes – is 50 percent, relative to an unrestrained occupant**
 - **The average fatality reduction by frontal air bags for belted occupants in frontal crashes is 22 percent, relative to a belted occupant at a seat not equipped with an air bag**
 - **The average combined fatality reduction for seat belt use and air bags in frontal crashes is 61 percent, relative to an unrestrained occupant without an air bag**



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Frontal Fatality Reductions

- **Trends with and without FMVSS:**
 - **The rate of occupant fatalities in frontal crashes per billion miles for cars and LTVs decreased from 13.24 in 1975 to 5.74 in 2005**
 - **Fatalities in frontal crashes remained close to 16,000 per year while VMT of cars and LTVs increased from 1.2 trillion in 1975 to 2.7 trillion in 2005**
 - **Seat belts, air bags and other technologies that protect occupants saved an estimated 227,939 lives in frontal crashes from 1975 through 2005**



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Frontal Fatality Reductions

- **Trends with and without FMVSS:**
 - **Without the FMVSS, the number of frontal fatalities might have increased from 17,680 in 1983 to 31,370 in 2005**
 - **Occupant fatalities in frontal crashes per billion miles actually decreased from 9.91 in 1983 to 5.74 in 2005**
 - **Without the increase in belt use, frontal air bags and other FMVSS, the fatality rate would have remained nearly unchanged in that time span.**



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ODI Involvement

- **Fatal consumer complaints are monitored and tracked by ODI**
- **Reported air bag and seat belt issues are followed up**
- **Inadvertent and nondeployments make up almost 80% of the type of air bag investigations**



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ODI Involvement

- **The vehicle's air bag light/diagnostic (ABL) system constantly monitors the status and is effective in detecting the first sign of a fault within an air bag electrical related component and wiring**
 - **When ODI identifies an ABL system trend, it aggressively investigates**
 - **NASS forwards any Field Safety Notifications (FSN) to ODI for review and cross-checking in their databases for trends**
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Effects of Belt Usage

- **Effects belt usage and air bag proliferation have had on serious and fatal injuries:**
 - **Overall, seat belts have had a positive effect in reducing the injury levels**
 - **Statistically significant in “full frontal”, “offset”, “other centered” frontal crashes, but not in “narrow offset” frontal crashes**
 - **For belted and airbag deployed, the percentage of moderate injury (MAIS 2+) is significantly lower for MY 1998-2006, compared to MY 1992-1997, in “other centered” frontal crashes**



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Effects of Belt Usage

- **Effects belt usage and air bag proliferation have had on serious and fatal injuries:**
 - **For unbelted and airbag deployed, the percentage of moderate injury (MAIS 2+) is significantly lower for MY 1998-2006, compared to MY 1992-1997, in “narrow offset” frontal crashes with Delta-V=20+ mph**



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Nondeployment Fatal

- **Fatalities did occur in frontal crashes where an air bag did not deploy**
 - **Of 743 frontal fatality cases on CDS, 52 (7.0 percent) were nondeployments**
 - **NHTSA reviewed the 52 nondeployments and concluded that a deployment would typically have been expected – based on the type of impact and its severity, and the performance of other vehicles – in only 10 of them (1.3 percent of the original 743 frontal fatalities)**
 - **In only 6 of these cases (0.8 percent of the original 743) could a deployment have benefited the occupant – based on the occupant’s trajectory, contacts and injuries**



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CDS and FARS Nondeployment Comparison

- **In 1998-2006 FARS, for 52,892 occupant fatalities that FARS classifies as frontal and indicate whether the air bag deployed – and where the VIN clearly indicates the vehicle was equipped with air bags**
- **25.7 % of the cases are not deployments**
 - **(17% did not deploy and 8.7% not equipped with an air bag)**



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CDS and FARS Nondeployment Comparison

- **711 fatality cases that 1998-2006 FARS called “frontal” are also on CDS**
 - **According to CDS, 115 (16.2 percent) did not deploy**
- **However, among these 115 nondeployments:**
 - **82 were in crashes where, according to CDS, the principal impact was not frontal (secondary impacts may have been frontal)**
 - **In none of these cases would a deployment typically be expected and likely to benefit the occupant.**



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CDS and FARS Nondeployment Comparison

- **33 were in crashes where, according to CDS, the principal impact was frontal. Of these:**
 - **7 would typically have been expected to deploy (1.0 percent of the original 711), and**
 - **4 could, in addition, likely have benefited the occupant if they had deployed (0.6 percent of the original 711)**



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KC Star Evaluation

- **The *Kansas City Star* reported that 2001-2006 FARS included “at least 1,400 drivers and right-front passengers” fatally injured in directly frontal, non-rollover crashes where air bags did not deploy**
- **NHTSA attempted to replicate the *Kansas City Star*’s analysis and identified 1,446 cases where FARS explicitly says air bags did not deploy**



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KC Star Evaluation

- **17 of these 1,446 FARS-identified nondeployment cases are also on CDS**
 - **With documented inspections CDS indicated:**
 - **4 in fact deployed**
 - **3 could not have deployed, because the air bag was not replaced after a previous crash**
 - **10 were actually equipped with air bags that did not deploy**
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KC Star Evaluation

- **In addition to these 10, CDS also included 4 other nondeployments in crashes meeting the *Kansas City Star's* criteria, but, according to FARS, “deployed” or “unknown if deployed.” Among these 14 actual nondeployments:**
 - **3 would typically have been expected to deploy, and**
 - **These 3 could, might have benefited the occupant if they had deployed**



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Frontal Team Conclusions

- **Seat belt use and air bags are each quite effective in reducing fatality risk in frontal impacts**
- **The combination of seat belt use and air bags is even more effective**



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Frontal Team Conclusions

- **The number of frontal fatalities stayed about the same in 1975-2005 while VMT more than doubled**
- **Simply stated: the fatality rate per billion miles has been reduced by more than half**
- **From 1983 almost the entire reduction in the frontal fatality rate per billion miles may be attributed to increased belt use, frontal air bags and other FMVSS**



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Frontal Team Conclusions

- **In only approximately 1 percent of fatal frontal crashes through 2006, the air bag did not deploy, could typically have been expected to deploy and might have benefited the occupant if it had deployed**
- **Because FARS data is police reported, detailed assessments of frontal crashes cannot be performed accurately because:**
 - ◆ **FARS overreports the proportion of nondeployments**
 - ◆ **FARS “frontals” include many cases where the frontal impact is only a minor secondary impact; and**
 - ◆ **FARS does not identify if a deployment would typically have been expected and could have benefited the occupant**



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Frontal Team Conclusions

- **There are known limitations to the crash protection provided by air bags**
- **Existing frontal air bags are not designed for all possible crash types (underride / override; off roadway multiple objects)**
- **Evolving technologies can help mitigate injuries in a vehicle crash include (e.g., seat belt tension devices, improved air bag electronics, crash avoidance sensors/devices, etc.**



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Frontal Team Conclusions

- **The *Kansas City Star* greatly exaggerated the issue of nondeployments in frontal crashes**
- **Only a small proportion of their FARS cases are:**
 - ◆ **Genuine nondeployments and**
 - ◆ **Impacts where a deployment would typically have been expected and could have benefited the occupant**



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Future Possibilities

NHTSA's Office of Vehicle Safety Research is studying various facets:

◆ **Crash Avoidance**

- **Technologies (ACAT, ITS)**
- **Human Factors (Warning systems, teen drivers, alcohol interlock)**
- **Visibility and lighting**
- **Motorcycle brakes**
- **Heavy vehicles (ESC)**



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Future Possibilities

NHTSA's Office of Vehicle Safety Research is studying various facets:

◆ **Crashworthiness**

- **Biomechanics (Dummy enhancement)**
- **Compatibility**
- **Integrated Frontal Safety (Advanced restraints, Crash imminent braking)**



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Future Possibilities

NHTSA's Office of Vehicle Safety Research is planning **future** research in:

- ◆ **Consumer Information (additional advanced technologies for rating systems)**
- ◆ **Crash Avoidance (vehicle-to-vehicle communication, ACAT projects, SHRPII 2,500 car study, etc.)**
- ◆ **Crashworthiness (Offset, Assess brain and chest injuries in frontal crashes, Vehicle restraint improvements compatibility)**



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Future Possibilities

Three most promising items for future reduction of frontal fatalities are:

1. Crash imminent braking

- ◆ **Sensors preview crash and improve crashworthiness through auto braking**



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Future Possibilities

Three most promising items for future reduction of frontal fatalities are:

2. Brake Assist Plus

- o **Provides a warning and pre-charges the brake system but no automatic braking**

3. Forward Collision Warning with automatic braking

- o **Using radar or laser technology to warn the driver if a vehicle in front - given the speed of both vehicles - gets too close then applies brakes**