Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (2000-48-061K)

1998 Mercedes ML320

Alabama

March/2000

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16. Abstract

This case is being initiated in response to the deployment of a redesigned air bag. The case was identified through NASS and is being investigated as a RABSS/Combination case. DSI was notified of the case June 21, 2000. The crash occurred in March, 2000 at 1630 hours. The crash occurred on a curved two-lane undivided dirt roadway. The weather was clear and the roadway was dry and free of defects. The speed limit is 64 km/h (40 mph).

Vehicle 1, a 1998 Mercedes-Benz ML320 sport utility vehicle driven by a 45-year-old female (170 cm/73 kg), was traveling westbound on the left hand curved roadway at a police estimated speed of 64 km/h (40 mph). The front right seat was occupied by a 10-year-old male (122 cm/48 in., 45 kg/99 lbs.). Both occupants were wearing the available lap and shoulder belts.

The driver lost control of the vehicle in the curve and departed the roadway on the right. The driver overcorrected to the left, departed the roadway, struck an embankment, and then struck a tree with its front end (01FYEW2). Vehicle 1 then rotated out and struck an additional tree with its left side (09LPAN3).

The driver sustained rib fractures, a left radius/ulna fracture, a sternum contusion, facial lacerations, and a black eye. The driver was hospitalized for four days.

The front right occupant sustained a left orbit fracture, an eyelid contusion/abrasions, and facial abrasions. He was transported to a local hospital where he was treated and released. He was scheduled to see an ophthalmologist the next day.

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Summary

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The crash occurred in March, 2000 at 1630 hours. The crash occurred on a curved two-lane undivided dirt roadway. The weather was clear and the roadway was dry and free of defects. The speed limit is 64 km/h (40 mph).

Vehicle 1, a 1998 Mercedes-Benz ML320 sport utility vehicle driven by a 45-year-old female (170 cm/73 kg), was traveling westbound on the left hand curved roadway at a police estimated speed of 64 km/h (40 mph). The front right seat was occupied by a 10-year-old male (122 cm/48 in., 45 kg/99 lbs.). Both occupants were wearing the available lap and shoulder belts.

Figure 1. Overview showing path of travel and impact with tree (impact 2)

Figure 2. Impact with tree (impact 2)

Crash Events

The driver lost control of the vehicle in the curve and departed the roadway on the right. The driver overcorrected to the left, departed the roadway, struck an embankment (unknown CDC), and then struck a tree with its front end (01FYEW2). Vehicle 1 sustained a longitudinal delta v of -18 km/h (-11 mph). Both front air bags deployed at this time. Vehicle 1 then rotated out in a counterclockwise direction and struck an additional tree with its left side (09LPAN3).

The driver sustained rib fractures, a left radius/ulna fracture, a sternum contusion, facial lacerations, and a black eye. The driver was hospitalized for four days.

The front right occupant sustained a left orbit fracture, an eyelid contusion/abrasions, and facial abrasions. He was transported to a local hospital where he was treated and released. He was scheduled to see an ophthalmologist the next day.

Figure 3. Front view, Vehicle 1

Table 1. Delta V (Impact 2)

	Case Vehicle	
	km/h	mph
Total	19	11.8
Longitudinal	-18	-11.2
Lateral	-7	-4.3

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Mercedes M
VIN	4JGAB54E4WAxxxxxx
CDC - Impact 1 CDC - Impact 2 CDC - Impact 3	Unknown 01FYEW2 09LPAN3

Figure 4. Front view, Vehicle 1, closeup

Figure 5. Left side view, Vehicle 1 (impact 3)

Table 3. Crush Measurements

Plane of Impact	Field L cm/in.	C1 cm/in.	C2 cm/in.	C3 cm/in.	C4 cm/in.	C5 cm/in.	C6 cm/in.
Bumper	158	0	7	24	30	5	0
	62.2	0	2.8	9.4	11.8	2	0

Interior of Case Vehicle

Vehicle 1 was equipped with buckets seats in both outboard front seating areas. The front left seat track was adjusted to between the middle and rear most position. The front right seat track was adjusted to the rear most track position. There were no seat performance failures. Both front seats were equipped with adjustable head restraints that were not damaged.

The left rear side glass was broken out and there was intrusion through the left side (see Table 4).

Figure 6. Overview of front right and front left seating positions

Table 4. Intrusions

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
Door panel	Left rear	16	6.3	Lateral
Windshield	Front right	14	5.5	Longitudinal
B-pillar	Left front	10	3.9	Lateral
Roof side rail	Left front	9	3.5	Lateral
Roof	Left front	4	1.6	Vertical
Roof	Left rear	4	1.6	Vertical
Roof side rail	Left front	3	1.2	Lateral
Toe pan	Front left	3	1.2	Longitudinal
Floor pan	Left rear	3	1.2	Lateral
Toe pan	Front right	2	0.8	Longitudinal

Case Vehicle Occupant Protection Systems

Vehicle 1 was equipped with a steering wheel mounted driver's air bag, a top instrument panel front right passenger's air bag, a driver's side air bag, and a right front passenger's side air bag. Both front air bags deployed as a result of the crash.

The driver's air bag was housed in the steering wheel hub and was concealed by asymmetrical H-configuration cover flaps which were not damaged in the crash. The circular air bag was equipped with four tether straps and two vent ports. The bag was not damaged.

The front right air bag was housed in the top-instrument panel position and was concealed by a single rectangular shaped cover flap; the flap was no longer attached to the vehicle at the time of the vehicle inspection. The rectangular air bag was equipped with two tether straps and one vent port. The bag was not damaged.

Figure 7. Driver's air bag

Figure 8. Front right passenger's air bag

Case Vehicle Occupant Demographics

	Occupant 1		Occupant 2	
Age/Sex:	45/Female		10/Male	
Seated Position:	Front left		Front right	
Seat Type:	Bucket		Bucket	
Height (cm/in:):	170	66.9	122	48
Weight (kg/lbs).:	73	161	45	99.2
Pre-existing Medical Condition:	Hypertension, hypercholesterolemia, history of depression, Chronic Obstructive Pulmonary Disease (COPD)		None noted	
Body Posture:	Sitting upright, normal		Sitting upright, normal	
Hand Position:	Both hands on wheel, position not known		Unknown	
Foot Position:	Right foot on brake, left on floor		Unknown	
Restraint Usage:	Lap and shoulder belt used		Lap and shoulder belt used	
Air bag:	Deployed		Deployed	

Occupant Injuries

Table 5. Injuries (01)

Injury	Injury Severity (AIS)	Injury Mechanism
Left mid to distal 1/3 radius fracture (displaced and comminuted)	3	Air bag
Ulna fracture (displaced and comminuted)	3	Air bag
Central chest contusion	1	Restraint
Right chest contusions	1	Restraint
Left side rib fractures	2	Left side interior surface

Table 6. Injuries (02)

Injury	Injury Severity (AIS)	Injury Mechanism
Left orbit fracture	2	Air bag
Eye lid contusion	1	Air bag
Abrasion, left cheek	1	Air bag
Eyelid abrasion	1	Air bag

Occupant Kinematics

The driver of Vehicle 1 was seated in the left front bucket seat in a normal, upright manner. She was wearing the available lap and shoulder belt. The belt anchorage was in the full up position. The seat was adjusted to between the middle and rear positions. The tilt steering wheel was found to be in the full up position at the time of the vehicle inspection. Prior to the first impact, Vehicle 1 was beginning a counterclockwise rotation–pushing this occupant to the right somewhat. At the initial impact, this occupant pitched forward slightly and to the right–loading the lap and shoulder belts to some degree. At the second impact, this occupant continued the forward movement engaging the seat belt further (causing the chest injuries) and engaging the deploying air bag. The driver's left forearm was likely contacted by the deploying air bag–causing the radius and ulna fractures. After the second impact, the vehicle rotated and struck another tree with its left side. This forced the driver to the left–where she stuck the side interior surface of the door and caused the left side rib fractures.

The front right occupant was seated in a normal, upright manner. He was wearing the available lap and shoulder belt. The belt anchorage was also in the full up position. His seat was adjusted to the rear most position. Prior to the first impact, Vehicle 1 was beginning a counterclockwise rotation–pushing this occupant to the right somewhat. At the initial impact, this occupant pitched forward slightly and to the right–loading the lap and shoulder belts to some degree and caused this occupant to close the distance between his face and the air bag module. At the second impact, this occupant continued the forward movement engaging the seat belt further and then engaging the deploying air bag with the left side of his face–causing the left side facial abrasions and the orbit fracture.

Scene Diagram