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## REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN-04-017

LOCATION - Arkansas

VEHICLE - 1997 Mercury Mountaineer

CRASH DATE - April 2003

Submitted:

March 15, 2005



Contract Number: DTNH22-01-C-07022

Prepared for:

U.S. Department of Transportation  
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Washington, D.C. 20590-0003

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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| 15. Supplementary Notes<br>Remote investigation of an air bag deployment crash involving a 1997 Mercury Mountaineer, equipped with three-point manual safety belts and dual air bags, that impacted a tree  |  |                             |   |                            |  |
| 16. Abstract<br>This report covers a remote investigation of an air bag deployment crash involving a 1997 Mercury Mountaineer (case vehicle) that ran off road and impacted a tree. This crash is of special interest because the case vehicle's unrestrained front right passenger (6-year-old female) sustained critical head and neck injuries from her deploying front right passenger air bag module cover flap and air bag, resulting in her death. The case vehicle was traveling eastward in the eastbound lane of a two-lane county road and intended to continue straight ahead. It was dark (i.e., not yet dawn and not lighted) and the weather was clear. The roadway was straight and level, the asphalt surface was dry and free of defects with very faded double yellow painted lines separating the east and westbound lanes. A loose object fell out of an eastbound pickup truck that was ahead of the case vehicle. The case vehicle's driver steered to the right and probably braked, successfully avoiding the loose object. The case vehicle went off the right (south) side of the roadway and the driver steered sharply left. The case vehicle re-entered the roadway in a counterclockwise yaw, traveled obliquely across the roadway leaving critical curve scuffs and continued off the north (left) edge. The front of the case vehicle impacted a small tree that was close to a barbed wire fence and a larger tree. The case vehicle's front bumper bent the small tree forward against the fence and the larger tree such that the fence and larger tree acted to reinforce the smaller tree and this impact caused the case vehicle's driver and front right passenger air bags to deploy. The front right passenger was probably very close to the air bag module as the air bag deployed. The front right passenger's air bag module cover flap struck her in the neck and jaw, causing: lacerations and contusions on her neck; fracture and dislocation of vertebra C2; a fracture of the mandible; non-anatomic brain injuries; and other injuries. She was air-lifted to a hospital via helicopter, where she was declared dead approximately 100 minutes post-crash. She was not autopsied. The case vehicle was towed, but it was probably drivable. |  |                             |   |                            |  |
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This remote investigation was brought to the NHTSA's attention in April 2004 by a newspaper clipping service. This crash involved a 1997 Mercury Mountaineer (case vehicle) that ran off the road and impacted a tree. The crash occurred in August 2003 at 5:28 a.m. in Arkansas and was investigated by the applicable sheriff's department. This crash is of special interest because the case vehicle's unrestrained front right passenger (6-year-old female, white, unknown if Hispanic) sustained critical head and neck injuries from her deploying front right passenger air bag module cover flap and air bag, resulting in her death. It was discovered that the case vehicle was not available to be inspected and the case was conducted as a remote investigation. This report is based on the police crash report, police on-scene photographs, medical treatment data, and this contractor's evaluation of the available evidence.

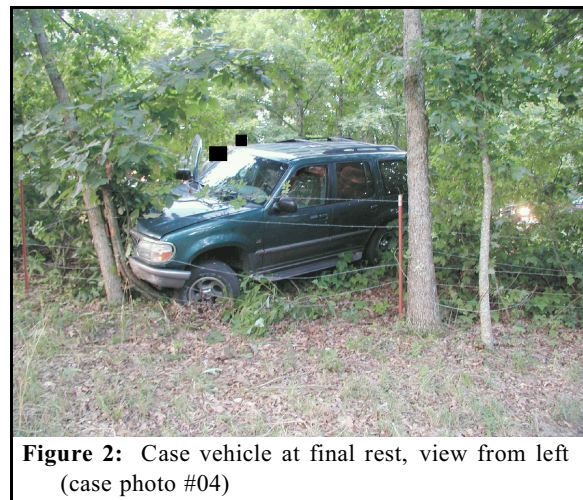
### CRASH CIRCUMSTANCES

The case vehicle was traveling eastward in the eastbound lane of a two-lane county road and intended to continue straight ahead. It was dark (i.e., not yet dawn and not lighted) and the weather was clear. The roadway was straight and level, the asphalt surface was dry and free of defects with very faded double yellow painted lines separating the east and westbound lanes, no edge lines, no shoulders and no posted speed limit. A loose object (wooden sawhorse) fell out of an eastbound pickup truck that was ahead of the case vehicle. The case vehicle's driver steered to the right and probably braked, successfully avoiding the loose object. The case vehicle went off the right (south) side of the roadway and the driver steered sharply left. The case vehicle re-entered the roadway in a counterclockwise yaw, traveled obliquely across the roadway leaving critical curve scuffs and continued off the north (left) edge. The crash occurred on the roadside, a short distance off the north (left) road edge (Figure 1).

The front of the case vehicle impacted a small tree that was close to a barbed wire fence and a larger tree, approximately 4.9 meters [16 feet] north of the north road edge. The case vehicle's front bumper bent the small tree forward against the fence and the larger tree such that the fence and larger tree acted to reinforce the smaller tree and this impact caused the case vehicle's driver and front right passenger air bags to deploy. The small tree was approximately 10



**Figure 1:** East-west roadway at crash site, showing critical curve scuffs leading to north road edge departure and case vehicle's back (arrow) at final rest (case photo #02)



**Figure 2:** Case vehicle at final rest, view from left (case photo #04)

centimeters [4 inches] in diameter and it was approximately 0.5 meters [20 inches] south of the fence and larger tree. Two out of six strands of the barbed wire fence were broken (i.e., the case vehicle did not penetrate through the fence). The larger tree had a diameter of approximately 20 centimeters [8 inches] and was immediately adjacent to the inside edge of the fence. The roadside terrain sloped downhill from the road surface. At final rest, the case vehicle was heading north on the downhill slope, tilted to its left, with its front against the smaller tree and the barbed wire strands entangled in its grille and left headlamp assembly (**Figures 2 and 3**).

### CASE VEHICLE

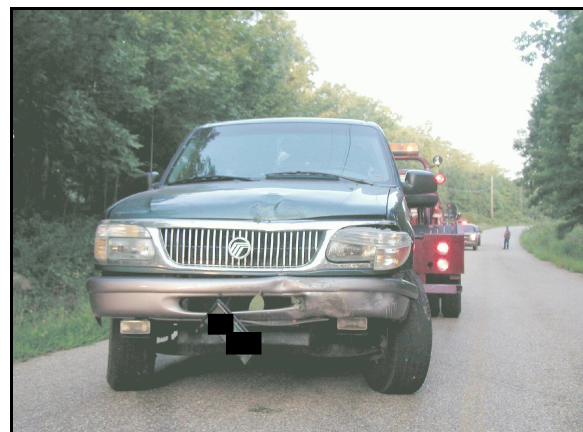
The case vehicle was a 1997 Mercury Mountaineer all wheel drive, four-door, five passenger sport utility vehicle (VIN: 4M2DU55PXVU-----), equipped with a 5.0 liter V8 gasoline engine and an automatic transmission with a column-mounted selector lever. The case vehicle was equipped with four wheel, anti-lock brakes and dual first generation frontal air bags. Its wheelbase was 283 centimeters [111.5 inches]. The odometer reading is not known. The case vehicle was towed away from the scene, but it was probably drivable.

The case vehicle sustained dents and scrapes on the left half of the front bumper and at the center of the grille and hood (**Figure 4**). The hood was slightly deformed and the left headlamp/turn signal assembly was slightly displaced. It appears that the left front suspension/steering assembly may have been slightly damaged, but this cannot be confirmed with the available documentation. None of the tires were deflated or restricted. There was spider web cracking low on the windshield directly above the front right air bag module and no other glazing damage.



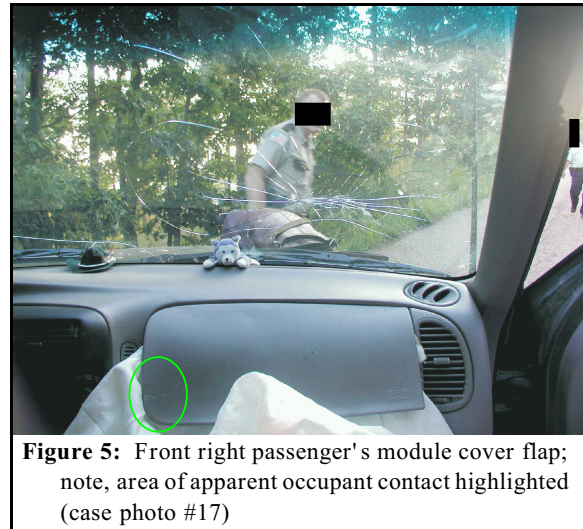
**Figure 3:** Case vehicle at final rest, view from front (case photo #09)

The CDC was estimated from the available photographs as **12-FYEW-1 (0)**. Because the case vehicle's impact involved objects that yielded, this collision is out of scope for the WinSMASH reconstruction program. This was a crash of low severity (14-23 km.p.h. [9-14 m.p.h.]) for the case vehicle.



**Figure 4:** Case vehicle's front (case photo #11)

The front right passenger's air bag module was located in the front of the instrument panel, with a single cover flap (**Figure 5**). The available photographs show only a small portion of the air bag fabric and do not provide any closeup views of any air bag system components. There is an area of slight deformation with smudges of what appears to be blood and/or other tissue at the left lower corner of the module cover flap. There is an area of focal cracking low in the windshield that is probably a result of the air bag cover flap striking the glazing. There were particles of sputum on the windshield in the area directly in front of the passenger's seat area.



The driver's air bag module was located in the steering wheel hub. The available photographs do not provide any useful views of the driver's air bag. The very limited views do not show any evidence of damage or contact on the module cover flaps or the air bag fabric.

#### CASE VEHICLE FRONT RIGHT PASSENGER'S KINEMATICS

The case vehicle's front right passenger (6-year-old female, white, unknown if Hispanic, 26 kilograms [57 pounds], height not known) was not using her available, active, three-point, lap-and-shoulder safety belt system. The police crash report indicates non-use and she did not sustain any of the typical safety belt-related injuries. Her seat adjustments and posture are not known.

The case vehicle's driver steered abruptly to the right and probably braked when a wooden saw horse fell out of a pickup truck immediately ahead of the case vehicle. The front right passenger probably moved forward and leftward in response to the deceleration and rightward motion resulting from this emergency maneuvering. The case vehicle went off the road to the right (south), into the grass along the roadside, and the driver steered to the left, attempting to get back on the road. The driver lost control and the case vehicle began rotating counterclockwise as it slid northward across the roadway, leaving critical curve scuffs on the asphalt pavement (see **Figure 1**). The front right passenger probably moved back to the right and further forward in response to the leftward steering and deceleration resulting from this out-of-control motion. The case vehicle ran off the road to the left (north), traversed the narrow strip of grass along the roadside and encountered the brush and shrubs beyond the grass. The ground on the roadside sloped down and away from the roadway and the case vehicle tilted to its left with its front down. The front right passenger was jostled erratically in response to the deceleration on the uneven terrain as the case vehicle tipped down and to its left. The case vehicle's front bumper impacted a small tree and began to bend it down but the small tree was pushed against a larger tree and a fence that reinforced the small tree. As the vehicle was stopped by this impact, the driver and front right passenger air bags deployed. The front right passenger was probably very close to the air bag module as the air bag deployed. The front right passenger's air bag module cover flap

struck her in the neck and jaw, causing: lacerations and contusions on her neck; fracture and dislocation of vertebra C2; a fracture of the mandible; and loosened teeth. Her interaction with the module cover flap was followed immediately by the air bag, which caused abrasions across the front of her neck and probably struck her face and head causing non-anatomic brain injuries. Her position at final rest is not known, but she was probably propelled upward and rearward by the force of the air bag and fell back into the front right seat.

**FRONT RIGHT PASSENGER'S INJURIES**

The front right passenger was transported via helicopter to a hospital, where she was pronounced dead approximately 100 minutes after the crash. She was not autopsied.

| Injury Number | Injury Description (including Aspect)  | NASS Injury Code & AIS 90 | Injury Source (Mechanism)        | Source Confidence | Source of Injury Data  |
|---------------|--|---------------------------|----------------------------------|-------------------|------------------------|
| 1             | Nonanatomic brain injury including unresponsiveness, agonal pulse, asystole, pupils fixed and dilated, GCS = 3   | critical<br>160824.5,0    | Air bag, front right passenger's | Probable          | Emergency room records |
| 2             | Fracture C <sub>2</sub> involving pedicles with dislocation (i.e., subluxation and distraction), severe—several centimeters, between C <sub>2</sub> and C <sub>3</sub> , and probable cord involvement | severe<br>650226.3,6      | Front right module's cover flap  | Probable          | Emergency room records |
| 3             | Fracture mandible, not further specified   | minor<br>250602.1,9       | Front right module's cover flap  | Probable          | Emergency room records |
| 4             | Dislocation (loose) teeth, not further specified   | minor<br>251402.1,8       | Front right module's cover flap  | Probable          | Emergency room records |
| 5             | Abrasion across anterior neck  | minor<br>390202.1,5       | Air bag, front right passenger's | Probable          | Emergency room records |
| 6             | Contusion {hematoma, ecchymosis}, large, across anterior neck  | minor<br>390402.1,5       | Front right module's cover flap  | Probable          | Emergency room records |
| 7             | Lacerations anterior neck, not further specified   | minor<br>390600.1,5       | Front right module's cover flap  | Probable          | Emergency room records |
| 8             | Laceration dorsal surface right foot, not further specified  | minor<br>890600.1,1       | Unknown                          | Unknown           | EMS treatment record   |



The case vehicle's driver (30-year-old female, white, unknown if Hispanic, 160 centimeters, 75 kilograms [63 inches, 165 pounds]) was not using her available, active, three-point, lap-and-shoulder, safety belt system. The police crash report indicates non-use and she did not sustain any of the typical safety belt-related injuries. Her seat adjustments and posture are not known.

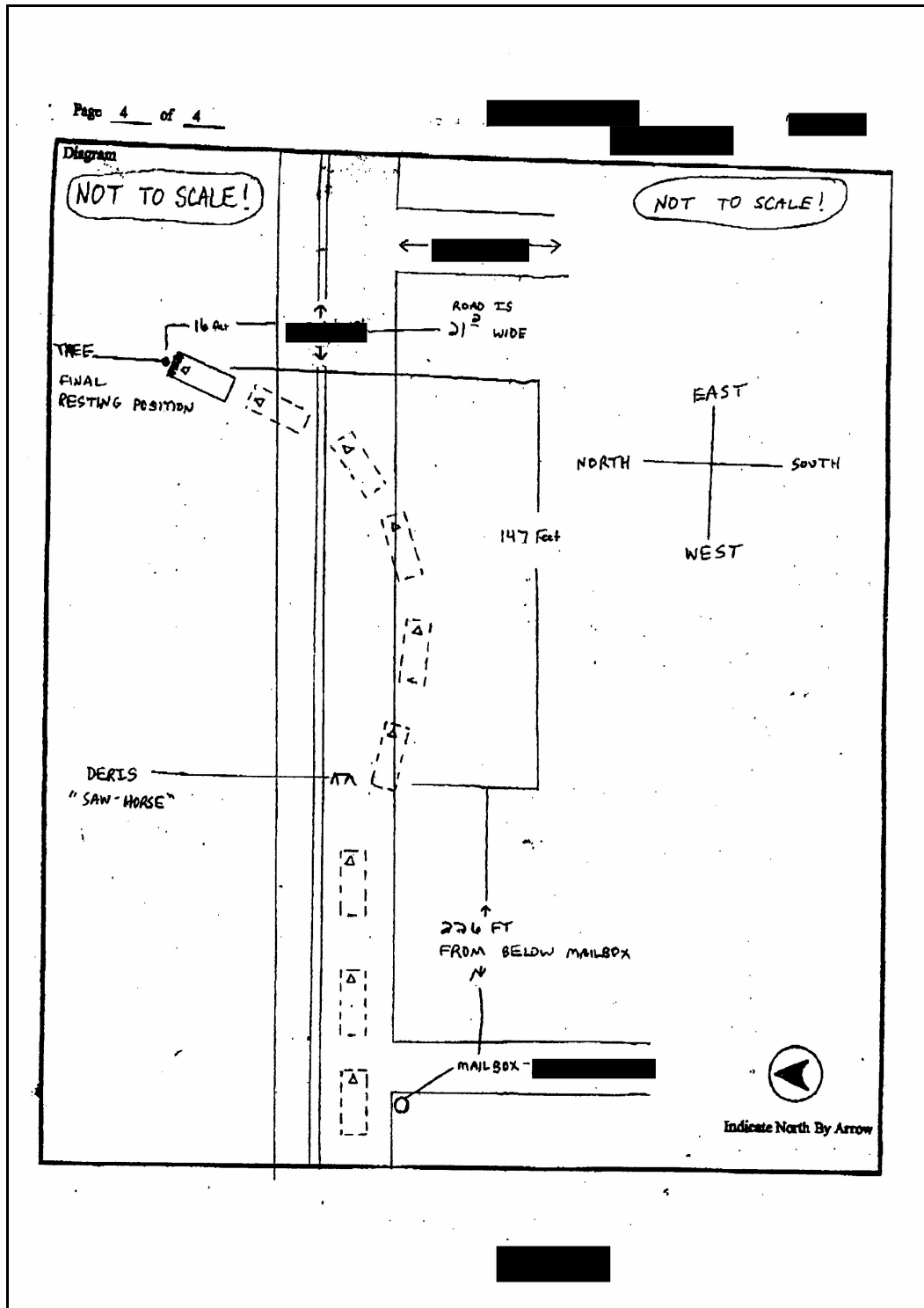
The case vehicle's driver steered abruptly to the right and probably braked when a wooden saw horse fell out of a pickup truck immediately ahead of the case vehicle, and she probably moved forward and leftward in response to the deceleration and rightward motion resulting from this emergency maneuvering. The case vehicle went off the road to the right (south), into the grass along the roadside, and she steered to the left, attempting to get back on the road. She lost control and the case vehicle began rotating counterclockwise as it slid northward across the roadway, leaving critical curve scuffs on the asphalt pavement (see **Figure 1**). The driver probably moved back to the right and further forward in response to the leftward steering and deceleration resulting from this out-of-control motion. The case vehicle ran off the road to the left (north), traversed the narrow strip of grass along the roadside and encountered the brush and shrubs beyond the grass. The ground on the roadside sloped down and away from the roadway and the case vehicle tilted to its left with its front down. The driver was jostled erratically in response to the deceleration on the uneven terrain as the case vehicle tipped down and to its left. The case vehicle's front bumper impacted a small tree and began to bend it down but the small tree was pushed against a larger tree and a fence that reinforced the small tree. As the vehicle was stopped by this impact, the driver and front right passenger air bags deployed. The driver encountered the driver's air bag with her chest and neck and she sustained: contusions and abrasions on her chin; contusions and abrasions on her neck; contusions on her shoulders and upper arms; and contusions on her chest, including her right breast. Her left knee probably impacted the knee bolster and she sustained a contusion. Her position at final rest is not known, but she probably rebounded back into her seat.

**CASE VEHICLE DRIVER'S INJURIES**

The driver was transported via helicopter to a hospital, where she was admitted for one day, for observation and treatment.

| Injury Number | Injury Description (including Aspect)                              | NASS Injury Code & AIS 90 | Injury Source (Mechanism)        | Source Confidence | Source of Injury Data   |
|---------------|--|---------------------------|----------------------------------|-------------------|-------------------------|
| 1             | Contusions {hematomas} to scalp and/or head, not further specified | minor<br>190402.1,9       | Unknown                          | Unknown           | Hospitalization records |
| 2             | Abrasions chin, small amount, not further specified                | minor<br>290202.1,8       | Air bag, front right passenger's | Probable          | Hospitalization records |
| 3             | Contusion chin, not further specified                              | minor<br>290402.1,8       | Air bag, front right passenger's | Probable          | Hospitalization records |
| 4             | Abrasion anterior neck, not further specified                      | minor<br>390202.1,5       | Air bag, front right passenger's | Probable          | Emergency room records  |

| Injury Number | Injury Description (including Aspect)   | NASS Injury Code & AIS 90 | Injury Source (Mechanism)                       | Source Confidence | Source of Injury Data   |
|---------------|---|---------------------------|---|-------------------|-------------------------|
| 5             | Contusion to neck, anteriorly   | minor<br>390402.1,5       | Air bag, front right passenger's                | Probable          | Hospitalization records |
| 6             | Contusion to chest, not further specified, including right breast with edema      | minor<br>490402.1,4       | Air bag, front right passenger's                | Probable          | Hospitalization records |
| 7             | Contusions to bilateral shoulders and bilateral upper arms, not further specified | minor<br>790402.1,3       | Air bag, front right passenger's                | Probable          | Hospitalization records |
| 8             | Contusion {bruise}, 2 cm (0.8 in) left knee not further specified                 | minor<br>890402.1,2       | Knee bolster, driver's, left of steering column | Probable          | Hospitalization records |



Copied from police crash report.