Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (DS99025)

1998 Mercury Mystique

California

June / 1998

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16. Abstract

This remote investigation was initiated in response to a possible redesigned air bag deployment. The case was selected from the FARS data files. The redesigned air bag was installed in a 1998 Mercury Mystique four-door sedan. This was a single vehicle crash that occurred during the late afternoon hours of a summer weekend day in June, 1998. The level bituminous roadway surface was dry and the weather was clear. The roadway consists of one northbound travel lane and one southbound travel lane. A double solid yellow (no passing) centerline separates the two travel lanes. The roadway is bordered by asphalt shoulders. The roadway was constructed through a low lying wetlands area, therefore, there is a fill embankment on each side of the roadway. There were no viewing obstructions at the crash location and the posted speed limit is 89 km/h (55 mph). Vehicle 1, a 1998 Mercury Mystique four-door sedan, was driven by a 46 year-old-female who was wearing the available three-point manual lap and shoulder belt. The front, right seated occupant was a 26 year-old-male (unknown restraint usage). The passenger was reclined in the front, right seated position. Driver 1 successfully negotiated a left curve in the roadway and had entered a straight section when Driver 1 lost control of the vehicle. Apparently , an insect (possibly a bee) was in the passenger compartment and the driver reportedly flailed her right arm. The Mercury Mystique (Vehicle 1) initiated a clockwise yaw and traversed the road edge line to her right (west). The front, right corner of Vehicle 1impacted the end of a W-beam guardrail (Crash Event #1) and continued to rotate in a clockwise direction. Vehicle 1 rotated approximately 295 degrees in a clockwise direction before initiating a 5-quarter turn rollover sequence (Crash Event #2). The top plane of the Mercury Mystique impacted a utility pole crushing the roof and A-pillars vertically downward intruding into the passenger compartment. After the pole impact, Vehicle 1rebounded, coming to rest on all four tires and facing southeast. The front, right bumper corner impact with the guardrail was of insufficient force to deploy the redesigned frontal air bags and the rollover and utility pole impacts were non-horizontal directions of force. The driver of the Mystique was partially ejected through the front, left window opening. Driver 1 was fatally injured as her head impacted the utility pole. Driver 1 sustained numerous abrasions, lacerations and contusions (AIS-1) to her face and extremities. She sustained comminuted orbital roof fractures (AIS-3), severe, comminuted eggshell type fracture of the calvarium and the basilar skull (AIS-4), fractured right clavicle (AIS-2), multiple right side rib fractures with associated hemorrhage (AIS-3). Driver 1 also sustained the following anatomical brain lesions; contusions of the left parietal and temporal lobes (AIS-3), subarachnoid hemorrhage (AIS-3), lacerated frontal lobes (AIS-4), deep contusion hemorrhages in the left thalamus, mid-brain and pons (AIS-5) and a contused (AIS-3) and lacerated right lung lobe(AIS-4). The front, right seated occupant sustained serious injuries and was air-lifted from the crash scene to a hospital were he was admitted and treated for his injuries.

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Summary

This remote investigation was initiated in response to a possible redesigned air bag deployment. The case was selected from the FARS data files. The redesigned air bag was installed in a 1998 Mercury Mystique four-door sedan. This was a single vehicle crash that occurred during the late afternoon hours of a summer weekend day in June, 1998. The level bituminous roadway surface was dry and the weather was clear. The roadway consists of one northbound travel lane and one southbound travel lane. A double solid yellow (no passing) centerline separates the two travel lanes. The roadway is bordered by asphalt shoulders. The roadway was constructed through a low lying wetlands area, therefore, there is a fill embankment on each side of the roadway. There were no viewing obstructions at the crash location and the posted speed limit is 89 km/h (55 mph).

Vehicle 1, a 1998 Mercury Mystique four-door sedan, was driven by a 46 year-old-female who was wearing the available three-point manual lap and shoulder belt. The front, right seated occupant was a 26 year-old-male (unknown restraint usage). The passenger was reclined in the front, right seated position. Driver 1 successfully negotiated a left curve in the roadway and had entered a straight section when she lost control of the vehicle. Apparently , an insect (possibly a bee) was in the passenger compartment and the driver reportedly flailed her right arm. The Mercury Mystique (Vehicle 1) initiated a clockwise yaw and traversed the road edge line to her right (west). The front, right corner of Vehicle 1impacted the end of a W-beam guardrail (Crash Event #1) and continued to rotate in a clockwise direction. Vehicle 1 rotated approximately 295 degrees in a clockwise direction before initiating a 5-quarter turn rollover sequence (Crash Event #2). The top plane of the Mercury Mystique impacted a utility pole crushing the roof and A-pillars vertically downward intruding into the passenger compartment.

Figure 1. Aerial view of crash scene

Figure 2. Aerial view of crash scene

Figure 3. Pre-impact trajectory of Vehicle 1

Figure 4. Vehicle 1 initiates clockwise rotation

Figure 5. Guardrail impact

After the pole impact, Vehicle 1 rebounded, coming to rest on all four tires and facing southeast. The front, right bumper corner impact with the guardrail was of insufficient force to deploy the redesigned frontal air bags and the rollover and utility pole impacts were non-horizontal directions of force. The driver of the Mystique was partially ejected through the front, left window opening. Driver 1 was fatally injured as her head impacted the utility pole.

Figure 6. Pre-Rollover View

Driver 1 sustained numerous abrasions, lacerations and contusions (AIS-1)to her face and extremities. She sustained comminuted orbital roof fractures (AIS-3), severe, comminuted eggshell type fracture of the calvarium and the basilar skull (AIS-4), fractured right clavicle (AIS-2), multiple right side rib fractures with associated hemorrhage (AIS-3). Driver 1 also sustained the following anatomical brain lesions: contusions of the left parietal and temporal lobes (AIS-3), subarachnoid hemorrhage (AIS-3), lacerated frontal lobes (AIS-4), deep contusion hemorrhages in the left thalamus, mid-brain and pons (AIS-5) and a contused (AIS-3) and lacerated right lung lobe (AIS-4). The front, right seated occupant sustained serious injuries and was air-lifted from the crash scene to a hospital were he was admitted and treated for his injuries.

Figure 7. View showing rollover area

Figure 8. View showing pole impact and Vehicle 1's final rest

Exterior of Case Vehicle

Table 1. Vehicle Information

Model year, make and model	1998 Mercury Mystique
VIN	Unknown
CDC (Primary-Third Event) CDC (Secondary-Second Event) CDC (Secondary-First Event)	00-TPDN4 00LYAO3 01FRLE1

Figure 9. Right side of Mercury

Figure 10. Damaged front, right tire/ tripping force resulting in rollover

Interior of Case Vehicle

The interior of the Mercury Mystique sustained severe damage. The right A-B and C-pillars were cut by rescue personnel. The left B&C-pillars were also cut for the purpose of extricating the front, right seated passenger. Due to the altered vehicle damage, the degree of passenger compartment intrusion could not be ascertained; however, the actual intruding components were identified. The windshield was damaged due to the impact force and appeared to have had integrity loss, however, it is unknown if the partial bond separation was caused by the rescue efforts or ocurred during the crash. The front left and front, right side window glazing disintegrated either as a result of the rollover or the utility pole impact to the roof. The roof panel at the front, right seated position appeared to be the leading intruding component.

This vehicle is equipped with front, forward facing bucket seats, while the second row is equipped with a split bench with folding seatbacks. The two frontal seatbacks are equipped with adjustable head restraints which did not appear to be damaged. The rear split bench seat is not equipped with head restraints.

Table 2. Intrusions

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
Roof	Front, Right	unknown	unknown	Vertical
Roof	Front, Middle	unknown	unknown	Vertical
Roof	Front, Left	unknown	unknown	Vertical
Windshield	Front, Left	unknown	unknown	Vertical
Windshield	Front, Middle	unknown	unknown	Vertical
Windshield	Front, right	unknown	unknown	Vertical
A-Pillar	Front, Left	unknown	unknown	Vertical
A-Pillar	Front, Right	unknown	unknown	Vertical
Windshield Header	Front, Left	unknown	unknown	Vertical
Windshield Header	Front, Middle	unknown	unknown	Vertical

Case Vehicle Occupant Protection Systems

The 1998 Mercury Mystique was equipped with redesigned/depowered air bag units. The Mystique is equipped with two frontal crash sensors[1] which are located adjacent to the upper radiator support. There is a third safing sensor which is located in the lower right instrument panel. The air bag diagnostic monitor is located in the lower, center instrument panel, forward of the transmission selector lever. There is an air bag module located in the front left (steering wheel hub) and front right instrument panel (top-mount) which house the air bags and inflator units. The air bag indicator lamp is located in the lower left instrument cluster and will illuminate for approximately six seconds when the ignition is turned on. The front, left and front, right seated positions are equipped with manual three-point lap and shoulder belts which have mechanical seat belt pretensioners.

The driver air bag module is housed in the steering wheel hub and is concealed by a cover that has invisible "split lines" molded into its surfaces. The driver air bag module is equipped with one inflator, and a circular nylon air bag which has filled volume of 30 liters. The driver's air bag did not deploy as there was insufficient longitudinal deceleration due to the significant non-horizontal direction of force.

The front, right air bag is located above the glove compartment and is contoured into the top surface of the instrument panel. The module cover is "battle ax" shaped and is held by five clips and a short retaining strap. When the air bag deploys, the cover becomes free from the clips, but is held by the retaining strap. The passenger's air bag did not deploy due to the non-horizontal direction of force. There was insufficient longitudinal deceleration necessary for deployment**.**

[1] Refer to the attached Ford Contour/Mercury Mystique Supplemental Restraint Systems and Wiring Mapping Views

Case Vehicle Occupant Demographics

	Occupant 1	Occupant 2
Age/Sex:	46/Female	26/Male
Seated Position:	Front, Left	Front, Right
Seat Type:	Bucket	Bucket
Height (cm/in:):	Unk. Unknown	Unk. Unknown
Weight (kg/lbs).:	Unk. Unknown	Unk. Unknown
Pre-existing Medical Condition:	Right ovarian cyst	Unknown
Body Posture:	Unknown	Reclined in the front right seated position.
Hand Position:	Possibly right hand flailing off of steering wheel rim and left hand on rim, but unknown location	Most likely on lap
Foot Position:	Right foot on accelerator pedal and left foot on floor	Unknown
Restraint Usage:	Active, three-point lap and shoulder restraint used. Unknown if properly applied	Unknown
Air bag:	Non-deployed	Non-deployed

Occupant Injuries

Table 3. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Severe, comminuted eggshell type fracture of the calvarium and basilar skull	4	Utility Pole
Comminuted fracture of the right orbit	3	Utility Pole
Comminuted fracture of the left orbit	3	Utility Pole
Ragged 2 cm laceration to the right parietal region through which exudes blood and brain tissue	1	Utility Pole
Irregular 5x5cm abrasion with lines of abrasion oriented horizontally to the right side of head	1	Utility pole
Dicing type cut on lateral right eyebrow measuring .5cm	1	Utility pole
Contusion to left temple	1	Left door panel
Superficial cuts on left cheek	1	Left door panel
Multiple horizontal cuts (jagged) measuring up to 5cm long-left side of face	1	Left door panel and glass
Top of the right ear is lacerated and partially avulsed	1	Utility pole
1.5cm abrasion on the right lateral chest near axilla	1	Left A-pillar
Angular 3cm abrasion on the left upper back	1	Door panel
Horizontal superficial cuts & linear abrasions on the ventral forearm (unknown aspect)	1	Unknown source
Scattered punctate abrasions anterior medial upper arm (unknown aspect)	1	Unknown source
.7cm cut with embedded glass to the anterior aspect of the lower right thigh	1	Flying glass
Abrasion right ankle	1	Foot pedals
Multiple right-sided rib fractures including 2-6th ribs laterally, 2nd-8th anteriorly, 1st-6th posteriorly **Note:** Some rib fractures protrude into the right chest cavity and are associated with hemorrhage (Chest contains 150 ml of liquid blood)	3	Right A-pillar
Superficial pleural lacerations involve the right lower lobe	4	Right A-pillar
Contusion to the posterior surface of the right lower lung lobe	3	Right A-pillar
Fractured right clavicle near the acromion	2	Utility pole
Subcutaneous subgaleal hemorrhage	1	Utility pole
Generalized subarachnoid hemorrhage	3	Utility pole
Ragged superficial lacerations to the right frontal lobe	4	Utility pole
Ragged superficial lacerations to the left frontal lobe	4	Utility pole

Injury	Injury Severity (AIS)	Injury Mechanism
Contusion to the left parietal lobe	3	Utility pole
Contusion to the left temporal lobe	3	Utility pole
Deep contusion hemorrhages in the left thalamus, mid-brain and pons	5	Utility pole

Occupant Kinematics

The 46 year-old-female driver was in an upright posture and facing forward. She was wearing the available three-point manual lap and shoulder belt. Just prior to loss of control, the driver was apparently flailing with her right hand and arm. This action was in response to a possible insect (bee) in the passenger compartment. As she flailed with her right hand, she inadvertently steered to the right with her left hand still on the steering wheel rim. The case vehicle initiated a clockwise rotation. The driver was not significantly displaced as the front, right bumper corner impacted a W-beam guardrail. The vehicle continued to rotate (approximately 295 degrees from original heading), before its front, right tire loaded the paved shoulder edge which initiated a 5-quarter turn rollover sequence. She was maintained at her respective seated position; however she was partially ejected (head & right arm) through the front, left window opening. As the utility pole impacted the roof panel, the driver's head and right shoulder impacted the utility pole. There was a significant black creosote transfer smudge on her right shoulder region. The left A-pillar intruded vertically downward, significantly contacting the right side of her chest. The right side soft tissue facial injuries were a result of her contact with the utility pole. Her left side facial soft tissue injuries were due to impacting the left door panel. Her severe anatomical brain lesions (AIS 3-5) were due to the utility pole contact. The severe chest injuries (AIS-3 & 4) were due to the A-pillar intrusion.

The front, right seated occupant was in a reclined position apparently resting. He heard his wife yell and swing her right arm upward as if stung by a bee. It is unknown if he was restrained by the available three-point lap and shoulder belt. He was removed from the vehicle and was subsequently flown to a hospital where he was hospitalized and treated for his injuries. Due to the lack of information available, his kinematic pattern is basically unknown.

Scene Diagram