

Remote, Redesigned Air Bag Special Study
Dynamic Science, Inc., Case Number (DS99035)
1999 Mitsubishi Eclipse/1998 Ford Escort
California
December/1998

Technical Report Documentation Page

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<p>16. Abstract</p> <p>This remote investigation focused on the redesigned air bag system deployment of a 1999 Mitsubishi Eclipse GSX and a 1998 Ford Escort. The case was generated through the Fatal Accident Reporting System. This was a two vehicle crash involving the Eclipse and a Ford Escort; the driver of the Ford Escort was fatally injured. The case was conducted as a remote investigation. This crash occurred during the mid afternoon hours in December, 1998. The crash occurred on a two-lane, two-way eastbound/westbound rural highway. The asphalt roadway is straight and level. The speed limit is 89 km/h (55 mph).</p> <p>The first case vehicle, a 1999 Mitsubishi Eclipse GSX driven by a restrained 18-year-old male, was traveling westbound at an unknown speed. The front right seat was occupied by a restrained 20-year-old female. The second case vehicle, a 1998 Ford Escort driven by a 48-year-old female, was traveling eastbound at an unknown speed. The front right seat was occupied by a restrained 17-year-old female.</p> <p>The driver of the first case vehicle indicated that he was fatigued and that he had fallen asleep earlier in the trip. It appears that the driver fell asleep again and allowed the first case vehicle to drift into the eastbound travel lane. There is no indication that the driver of the Ford Escort saw the Mitsubishi and there does not appear that any avoidance actions were taken. The front of the first case vehicle (12FLEE9) struck the front of the second case vehicle (12FLEE9). Both front air bags in both vehicles deployed at this time.</p> <p>The Ford Escort was pushed into a sharp counterclockwise rotation. The vehicle tripped after rotating approximately 90 degrees and overturned. It overturned four quarter turns and came to rest back on its wheels on the roadway facing generally north approximately 29 m (95 ft) south of the impact area. The Mitsubishi Eclipse was redirected slightly in a counterclockwise direction. The vehicle continued traveling north before coming to rest in the southbound travel lane approximately 76 m (250) north of the area of impact.</p> <p>The driver of the Mitsubishi Eclipse sustained lacerations to his head and leg. He was transported by ground ambulance to a local hospital. The front right occupant of the Mitsubishi complained of pain to the neck. She was transported by ground ambulance to a local hospital. The driver of the Ford Escort was fatally injured.</p>			
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Summary

This remote investigation focused on the redesigned air bag system deployment of a 1999 Mitsubishi Eclipse GSX and a 1998 Ford Escort. The case was generated through the Fatal Accident Reporting System. This was a two vehicle crash involving the Eclipse and a Ford Escort; the driver of the Ford Escort was fatally injured. The case was conducted as a remote investigation. This crash occurred during the mid afternoon hours in December, 1998. The crash occurred on a two-lane, two-way eastbound/westbound rural highway. The asphalt roadway is straight and level. The speed limit is 89 km/h (55 mph).

Crash Events

The first case vehicle, a 1999 Mitsubishi Eclipse GSX driven by a restrained 18-year-old male (183 cm/72 in., 73 kg/161 lbs.), was traveling westbound at an unknown speed. The front right seat was occupied by a restrained 20-year-old female.



Figure 1. Left front corner, 1999 Mitsubishi Eclipse

The second case vehicle, a 1998 Ford Escort driven by an improperly restrained 48-year-old female (160 cm/63 in., 48 kg/107 lbs.), was traveling eastbound at an unknown speed. The front right seat was occupied by a restrained 17-year-old female.



Figure 2. Exterior, 1998 Ford Escort

The driver of the case vehicle indicated that he was fatigued and that he had fallen asleep earlier in the trip. It appears that the driver fell asleep again and allowed the Mitsubishi to drift into the eastbound travel lane. There is no indication that the driver of the Ford Escort saw the Mitsubishi and there does not appear that any avoidance actions were taken. The front of the Mitsubishi (12FLEE9) struck the front of the Ford (12FLEE9).

The Mitsubishi Eclipse sustained a longitudinal delta v of -26.7km/h (-16.6) mph¹ and a latitudinal delta v of 4.7 km/h (2.9 mph). Both front air bags deployed at this time. The Ford Escort sustained a longitudinal delta v of -38.2 km/h (-23.8 mph) and a latitudinal delta v of 6.7 km/h (4.2 mph). Both front air bags deployed at this time.

The Ford Escort was pushed into a sharp counterclockwise rotation. The vehicle tripped after rotating approximately 90 degrees and overturned (00TDDO4). It overturned four quarter turns and came to rest back on its wheels on the roadway facing generally north approximately 29 m (95 ft) south of the impact area. The Mitsubishi Eclipse was redirected slightly in a counterclockwise direction. The vehicle continued traveling north before coming to rest in the southbound travel lane approximately 76 m (250) north of the area of impact.

The driver of the Mitsubishi sustained lacerations to his head and leg. He was transported by ground ambulance to a local hospital. The front right occupant of the Mitsubishi complained of pain to the neck. She was transported by ground ambulance to a local hospital.

The driver of the Ford Escort was fatally injured. She sustained multiple skull fractures, lacerations to the right frontal lobe of the cerebrum, a sternal fracture, rib fractures, fracture of the 12th thoracic vertebra, transecting lacerations of the trachea and thyroid gland, a compound fracture of the right humerus, scalp lacerations, and multiple abrasions. The head injuries occurred when she was partially ejected and her head was caught between the roadway and the vehicle exterior. The front right occupant sustained an abrasion to the head. She was transported by helicopter to a local trauma center.

Both vehicles were towed from the scene due to damage.

Table 1. Delta V

	Mitsubishi Eclipse		Ford Escort	
	km/h	mph	km/h	mph
Total	27.1	16.8	38.8	24.1
Longitudinal	-26.7	-16.6	-38.2	-23.7
Lateral	4.7	2.9	6.7	4.2

Exterior of Case Vehicle (Mitsubishi Eclipse)

Table 2. Vehicle Information

Model year, make and model	1999 Mitsubishi Eclipse
VIN	Unknown
CDC	12FLEE9

¹Calculated using crush estimated from photos

Interior of Case Vehicle (Mitsubishi Eclipse)

The interior of the case vehicle sustained moderate damage. The bottom portion of the floorboard on the driver's side was pushed to the right front edge of the driver's seat. The lower left portion and center of the instrument panel was damaged along the center console. The front left side glass disintegrated from the impact forces.

Case Vehicle Occupant Protection Systems (Mitsubishi Eclipse)

The Mitsubishi Eclipse was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units. Both air bags deployed as a result of the initial impact.

The front left air bag was housed in the steering wheel hub and was concealed by symmetrical H-configuration cover flaps which do not appear to have been damaged in the crash. The front right air bag was housed in the mid-instrument panel position and was concealed by dual rectangular cover flaps which did not appear to have been damaged in the crash.

This vehicle is equipped with lap and shoulder belts in the front left and front right seating positions. Both shoulder belts are height adjustable. The investigating officer found that the plastic on the latch plate assembly of the driver's seatbelt was melted from friction with the webbed portion of the belt. The webbed portion of the belt showed areas of minor stretching. There were no signs of stretching on the front passenger seat belt or the right rear passenger seat belt.



Figure 3. Front right seat position, Vehicle 1



Figure 4. Front left seat position, Mitsubishi Eclipse

Exterior of Case Vehicle (Ford Escort)

Table 3. Vehicle Information

Model year, make and model	1998 Ford Escort
VIN	Unknown
CDC	Impact 1:12FLEE9 Impact 2: 00TDDO4

Interior of Case Vehicle (Ford Escort)

The interior of the case vehicle sustained moderate damage. The driver's seat was twisted to the left. The steering column had been detached from the instrument panel—indicating shear capsule separation. The left side driver's floorboard had been pushed into the driver's seat. The left side door panel was bowed outward. The front left side glass disintegrated from the impact forces.

Case Vehicle Occupant Protection Systems (Ford Escort)

The Ford Escort was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units. Both air bags deployed as a result of the initial impact.

The front left air bag was housed in the steering wheel hub and was concealed by symmetrical H-configuration cover flaps which do not appear to have been damaged in the crash. The front right air bag was housed in the instrument panel.

This vehicle is equipped with lap and shoulder belts in the front left and front right seating positions. The investigating officer indicated that both belts showed signs of stretching and displayed the seat belt use indicators (red replace seat belt tags).



Figure 5. Front left seating position

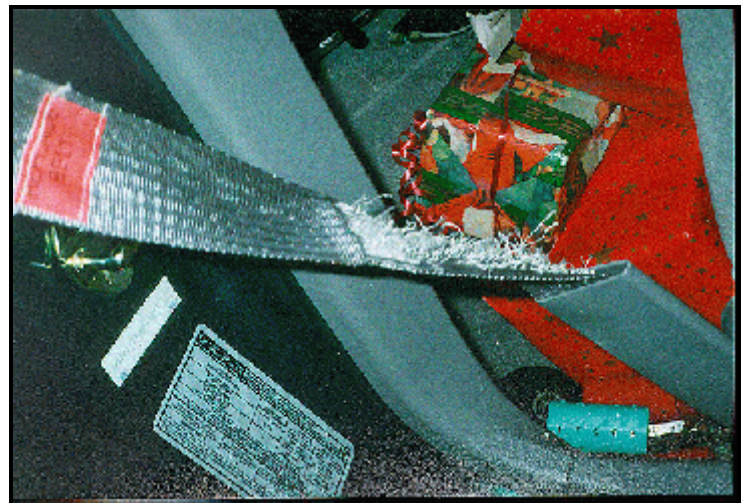


Figure 6. Front right seat belt—replace seat belt tag exposed (Ford Escort)

Case Vehicle Occupant Demographics (Mitsubishi Eclipse)

	Occupant 1	Occupant 2
Age/Sex:	18/Male	20/Female
Seated Position:	Front left	Front right
Seat Type:	Bucket with folding back	Bucket with folding back
Height (cm/in):	183 72	Unk Unk
Weight (kg/lbs):	73 161	Unk Unk
Pre-existing Medical Condition:	None noted	None noted
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used	Lap and shoulder belt used
Air bag:	Deployed at impact	Deployed at impact

Case Vehicle Occupant Demographics (Ford Escort)

	Occupant 1	Occupant 2
Age/Sex:	48/Female	17/Female
Seated Position:	Front left	Front right
Seat Type:	Bucket	Bucket
Height (cm/in.):	160 63	Unk Unk
Weight (kg/lbs):	48 107	Unk Unk
Pre-existing Medical Condition:	None	None noted
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used—shoulder portion was situated under the left arm pit rather than over the shoulder	Lap and shoulder belt used
Air bag:	Deployed at impact	Deployed at impact

Occupant Injuries (Mitsubishi Eclipse)

Table 3. Injuries (01)

Injury	Injury Severity (AIS)	Injury Mechanism
Laceration, head	190600.1,9	Possibly left side glass
Laceration, leg	890600.1,9	Possibly lower instrument panel

Table 4. Injuries (02)

Injury	Injury Severity (AIS)	Injury Mechanism
Neck pain	Not codeable	

Occupant Injuries (Ford Escort)

Table 5. Injuries (01)

Injury	Injury Severity (AIS)	Injury Mechanism
Lacerations, right frontal lobe of cerebrum	140688.4,1	Roof rail/roadway
Focal cerebral subarachnoid hemorrhage	140684.3,1	Roof rail/roadway
Laceration, proximal trachea	442604.3,4	Unknown
Laceration, thyroid gland	341404.2,5	Unknown
Multiple displaced fracture involving right frontal/parietal/temporal vault	150404.3,5 150404.3,1 150200.3,1	A-pillar / roadway
Hinge fracture, long axis of left petrous temporal bone and the sphenoid bone	150200.3,2	A-pillar / roadway
Fracture, squamous temporal basal region / right orbital plate	150200.3,8	A-pillar / roadway
Fracture, posterior ribs 1-4 left side, anterior rib 8	450230.3,2	Left side door panel
Sternal fracture	450804.2,4	Air bag / steering wheel
Compound fracture, right humerus	752604.3,1	Unknown
Fracture, 12 th thoracic vertebrae	650416.2,7	Unknown
Left frontal scalp laceration (3-1/2 in.)	290602.1,7	Unknown

Lacerations (1 in.) right posterior parietal scalp	290602.1,7	Unknown
Laceration (1-1/2 in.), upper surface of right foot	890602.1,1	Unknown
Abrasion, right anterior neck	390602.1,5	Unknown
Abrasion, left abdominal flank	590202.1,2	Door side panel
Abrasion, dorsal aspect right and left hands	790202.1,1 790202.1,2	Air bag
Laceration, right elbow	790600.1,1	Unknown
Laceration, posterior scalp	190402.1,6	Unknown
Laceration (3/4 in.), chin	290602.1,8	Air bag

Table 6. Injuries (02)

Injury	Injury Severity (AIS)	Injury Mechanism
Abrasion, head	190202.1,9	Air bag

Occupant Kinematics

Mitsubishi Eclipse

The driver of the Mitsubishi Eclipse was seated in the front left seat position. He was wearing the available manual lap and shoulder belt. This occupant appears to have fallen asleep and was likely not in a normal, upright position. The front right passenger may have been asleep. She was wearing the available manual lap and shoulder restraint. Seat belt usage was determined through the lack of prominent frontal contact evidence, and observations by the investigating police officer at the scene of the crash.

At impact, the occupants reacted to the 350 degree principle direction of force by moving forward and loading the lap and shoulder restraints. As the restraints locked, further forward movement of the occupants was prevented. The driver sustained a laceration to his lower leg, possibly from the lower instrument panel. The front right passenger complained of pain to her neck, but did not report any injuries. Both occupants of this vehicle were transported to a local hospital for treatment.

Ford Escort

The driver of the Ford Escort was seated in the front left seat position. She was wearing the available manual lap and shoulder belt incorrectly. The shoulder portion of the belt was situated under the left arm pit rather than over the shoulder. The front right occupant was wearing the available lap and shoulder belt. Seat belt usage was determined by the post-crash position of the seat belt for the driver and the “replace belt” tags for both seat belts.

At impact, the driver reacted to the 350 degree principle direction of force by moving forward and loading the lap and shoulder belt. She engaged the deployed air bag and loading it to a sufficient extent as to cause a shear capsule separation. As the vehicle began a sharp counterclockwise rotation, the driver was pitched to the left, striking the door side panel. Portions of her body—including her head—extended outside of the vehicle. As the rotation continued, the vehicle tripped and rolled over. As the left A-pillar / left roof rail came into contact with the roadway the driver’s head came between the roadway and the various vehicle components—causing the skull and facial fractures. The driver was declared dead at the scene by a fire department official.

At impact, the front right occupant reacted to the 350 degree principle direction of force by moving forward and loading the lap and shoulder restraints. As the restraints locked, further forward movement of this occupant was prevented. This occupant sustained an abrasion to her head. She was transported by helicopter to a local hospital.

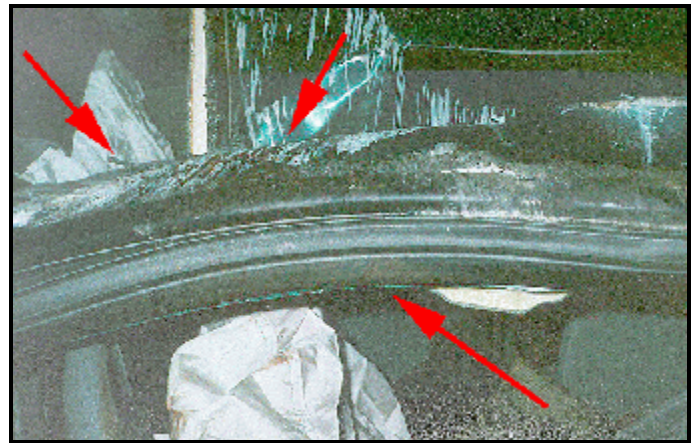


Figure 7. Hair/blood/tissue transfers to A-pillar area (Ford Escort)

Scene Diagram

