

**TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION**

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**VERIDIAN REMOTE REDESIGNED AIR BAG DEPLOYMENT
INVESTIGATION
SCI TECHNICAL SUMMARY REPORT**

NASS/SCI COMBO CASE NO. 1998-72-013C

VEHICLE - 1998 PONTIAC SUNFIRE

LOCATION - STATE OF ILLINOIS

CRASH DATE - FEBRUARY, 1998

Contract No. DTNH22-94-D-07058

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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 are 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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16. <i>Abstract</i> This remote investigation focused on a two vehicle crash involving a 1998 Pontiac 4-door sedan (subject vehicle) and a 1997 Mercury Grand Marquis 4-door sedan. The Pontiac Sunfire was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of a right angle collision with the Mercury Grand Marquis. The Mercury driver was operating the vehicle eastbound when he failed to observe the red traffic signal or northbound Pontiac as he proceeded straight through a 4-leg urban intersection. As the Mercury entered the intersection, the right side passenger area was struck by the frontal area of the Pontiac resulting in moderate damage to both vehicles. The restrained 54 year old female driver of the Pontiac Sunfire initiated a forward/lateral trajectory in response to the 10 o'clock impact force. Injury mechanisms relating to police reported (unspecified) incapacitating injuries could not be established as the NASS interview and medical report were not obtained. Both drivers were transported by ambulance to a local hospital for treatment and released.			
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BACKGROUND

This remote investigation focused on a two vehicle crash involving a 1998 Pontiac 4-door sedan (subject vehicle) and a 1997 Mercury Grand Marquis 4-door sedan. The Pontiac Sunfire was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of a right angle collision with the Mercury Grand Marquis. The Mercury driver was operating the vehicle eastbound when he failed to observe the red traffic signal or northbound Pontiac as he proceeded straight through a 4-leg urban intersection. As the Mercury entered the intersection, the right side passenger area was struck by the frontal area of the Pontiac resulting in moderate damage to both vehicles. The restrained 54 year old female driver of the Pontiac Sunfire initiated a forward/lateral trajectory in response to the 10 o'clock impact force. Injury mechanisms relating to police reported (unspecified) incapacitating injuries could not be established as the NASS interview and medical report were not obtained. Both drivers were transported by ambulance to a local hospital for treatment and released.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as CDS case number 98-72-013C. The Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA) assigned the Special Crash Investigation (SCI) team at Veridian the task of case review and final report preparation.

SUMMARY

Crash Site

This two vehicle crash occurred during the early morning hours of February, 1998. At the time of the crash, it was dark (street lighted) with rainy conditions as the roads were wet. The crash occurred in a straight and level 4-leg urban intersection (*NASS scene diagram unavailable*) which was controlled by an overhead traffic signal system in (flashing) red phase for east/west traffic. The north/south roadway consisted of five lanes while the east/west roadway consisted of three lanes. The posted speed limit at the crash scene was 48 km/h (30 mph).

Pre-Crash

The 69 year old male driver of the 1997 Mercury Grand Marquis was operating the vehicle eastbound (**Figure 1**) when he failed to observe the red overhead traffic signal as he proceeded straight through the urban 4-leg intersection. The 54 year old female driver of the 1998 Pontiac Sunfire was operating the vehicle northbound (**Figure 2**) when she observed the eastbound Mercury cross her path of travel. No pre-impact brake marks were documented at the scene indicative of driver avoidance maneuvers.



Figure 1. Eastbound approach for the 1997 Mercury Grand Marquis.



Figure 2. Northbound approach for the 1998 Pontiac Sunfire.

Crash

As the Mercury entered the 4-leg intersection, the right passenger area was struck by the frontal area of the Pontiac Sunfire resulting in moderate damage to both vehicles. Although the impact induced deceleration was sufficient to deploy the Pontiac's redesigned frontal air bag system, WinSMASH computed velocity changes could not be generated as both vehicles were under repair at the time of the NASS inspection. At this point, the Pontiac rotated clockwise and came to rest in close proximity to the point of impact facing northeast as the Mercury came to rest in the east sector of the intersection facing east.

Post-Crash

The exit status of and subsequent on-scene rescue efforts were unknown, however, both drivers were transported by ambulance to a local hospital for treatment and released. Both vehicles were towed from the scene due to disabling damage.

RABSS VEHICLE

The 1998 Pontiac Sunfire was identified by the Vehicle Identification Number (VIN): 1G2JB5247W7 (production sequence deleted). The vehicle was a 4-door sedan equipped with front wheel drive and a 2.2 liter, 4-cylinder engine. The vehicle's odometer reading was 3,584 km (2,227 miles) at the time of the crash. The police report listed the driver as the owner of the vehicle. The seating was configured with front bucket and rear bench seats (with folding backs). The NASS interview was not obtained, therefore, previous crashes or maintenance on the air bag system were unknown.

VEHICLE DAMAGE

Exterior Damage

The 1998 Pontiac Sunfire sustained moderate frontal damage as a result of the impact with the Mercury Grand Marquis (**Figure 3**). No

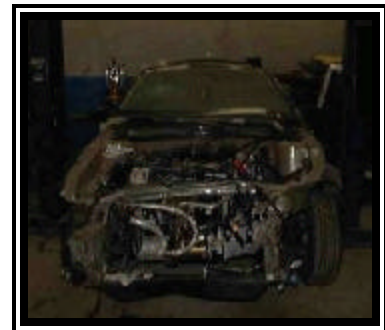


Figure 3. Front end repairs to the 1998 Pontiac Sunfire.

crush data was obtained as the vehicle was under repair at the time of inspection, however, visual observation of the damage revealed approximately 17.0 cm (6.7 in) of end shifting to the right which necessitated incrementation of the principal direction of force. The *estimated* Collision Deformation Classification (CDC) for this impact to the Pontiac was 70-FDEW-2 with a direction of force of (-)60 degrees. The bumper assembly, hood, and fenders were removed with no apparent induced damage to the door structures. The windshield was fractured from exterior impact forces and possibly the front right passenger air bag flap.



Figure 4. Dismantled 1997 Mercury Grand Marquis.

The 1997 Mercury Grand Marquis sustained moderate right side surface damage as a result of the impact with the Pontiac Sunfire (**Figure 4**). Although this vehicle was also under repair at the time of inspection, visual observation of the direct contact damage revealed pocketing at the right rear door area (right rear tempered glazing disintegrated) which became shallow as it extended rearward to the bumper corner. The estimated CDC for this impact to the Mercury was 99-RZEW-99 (*unknowns represented by 9's*).

Interior Damage

There was no damage to the interior surfaces of the Pontiac Sunfire from occupant contact or component intrusion.

REDESIGNED AIR BAG SYSTEM

The 1998 Pontiac Sunfire was equipped with redesigned frontal air bags for the driver and front right passenger positions (Figures 5. The air bags had deployed as a result of the crash. The driver air bag was housed in the center of the steering wheel with a vertically oriented flap tear seam (I-configuration). No contact evidence was identified on the air bag or exterior surface of the module cover flaps. The flaps were symmetrical in shape and measured 20.0



Figure 6. 1998 Pontiac Sunfire redesigned passenger air bag.

cm (7.9 in) in width and 7.0 cm (2.8 in) in height. The NASS researcher measured the diameter of the driver air bag at 44.0 cm (17.3 in) in its deflated state (**Figure 5**). The bag was tethered by two internal straps and vented by two ports located at the 10 o'clock and 2 o'clock sectors on the rear aspect of the air bag.

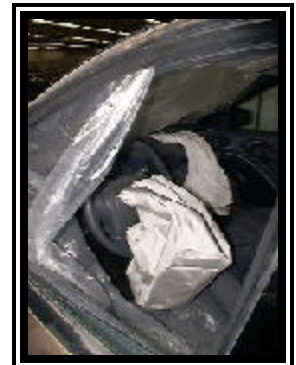


Figure 5. 1998 Pontiac Sunfire redesigned driver air bag.

The front right passenger air bag deployed from the right top instrument panel area with a single cover flap design hinged at the forward aspect (**Figure 6**). No contact evidence was identified on the air bag or exterior

surface of the module cover flap. The cover flap was rectangular in shape and measured 31.0 cm (12.2 in) in width and 13.0 cm (5.1 in) in height. The NASS researcher measured the passenger air bag at 40.0 cm (15.7 in) in width and 60.0 cm (23.6 in) in height in its deflated state. The bag was tethered by two internal straps. No vent ports or cutoff switch was reported for the front right passenger air bag.

DRIVER DEMOGRAPHICS

Age/Sex: 54 year old female
 Height: 168 cm (66 in)
 Weight: 75 kg (165 lb)
 Seat Track Position: Middle position
 Manual Restraint Use: 3-point lap and shoulder belt system
 Usage Source: NASS vehicle inspection, police report
 Eyewear: Unknown
 Type of Medical Treatment: Transported to a local hospital and released

Driver Injuries

<i>Injury</i>	<i>Severity (AIS 90)</i>	<i>Injury Mechanism</i>
Unknown		

Driver Kinematics

The 54 year old female driver of the 1998 Pontiac Sunfire was restrained by the available 3-point manual lap and shoulder belt system and presumed to be seated in an upright posture with the seat track adjusted to the middle position. At impact, she initiated a forward/lateral trajectory in response to the 10 o'clock impact force and sustained police reported unspecified incapacitating injuries. Limited vehicle and medical data prohibited a proper examination of the driver's injuries and associated injury mechanisms.