TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION

Calspan Corporation
Buffalo, New York 14225

CALSPAN REMOTE DEPOWERED AIR BAG DEPLOYMENT INVESTIGATION

CALSPAN CASE NO. CA98-01

VEHICLE - 1998 CHEVROLET LUMINA

LOCATION - PENNSYLVANIA

CRASH DATE - DECEMBER, 1997

Contract No. DTNH22-94-07058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, DC 20590

DISCLAIMER

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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 of the involved vehicle(s) or their safety systems.

TECHNICAL REPORT STANDARD TITLE PAGE

1. *Report No.* CA98-01	2. *Government Accession No.*	3. *Recipient's Catalog No.* 4. Weights
5. *Title and Subtitle* Calspan Remote Depowered Air Bag Deployment Investigation Vehicle - 1998 Chevrolet Lumina Location - Pennsylvania		6. *Report Date*: April, 1998 7. *Performing Organization Code*
8. *Author(s)* Crash Research Section		9. *Performing Organization Report No.*
10. *Performing Organization Name and Address* Transportation Sciences Crash Research Section Calspan Corporation P.O. Box 400 Buffalo, New York 14225		11. *Work Unit No.* 1115 (8220-8229) 12. *Contract or Grant No.* DTNH22-94-D-07058
13. *Sponsoring Agency Name and Address* U.S. Department of Transportation National Highway Traffic Safety Administration Washington, DC 20590		14. *Type of Report and Period Covered* Technical Report Crash Date: December, 1997 15. *Sponsoring Agency Code*

16. *Supplementary Notes*: Remote investigation into the injury mechanisms of a three-vehicle crash. The crash involved a 1998 Chevrolet Lumina, a 1998 Toyota Camry and a 1984 Pontiac Grand Prix, The Chevrolet Lumina and Toyota Camry were both equipped with a Supplemental Restraint System (SRS) that consisted of depowered driver and front passenger air bags. Only the SRS in the Chevrolet Lumina deployed as a result of the crash.

17. *Abstract*

The 1998 Chevrolet Lumina was driving west in the outboard lane of a four-lane road approaching a Y intersection at a reported speed of 40-48 km/h (25-30 mph). A 1998 Toyota Camry traveling east in the inboard lane was stopped intending to turn left to the intersecting road. Traffic backed-up in the inboard westbound lane separated allowing the Toyota to initiate the left turn. The Toyota emerged through the stopped traffic at an estimated 8 km/h (5 mph), directly in the path of the Chevrolet.

The driver of the Chevrolet initiated a clockwise steer input and braked in an attempt to avoid the Toyota. The left front of the Chevrolet struck the right front fender of the Toyota in an estimated 12 o'clock/2 o'clock impact configuration. The impact caused the depowered air bag system in the Chevrolet to deploy. The estimated delta V of the crash was 16-19 km/h (10-12 mph). The Toyota rotated counterclockwise as a result of the impact and contacted a 1984 Pontiac Grand Prix in a minor secondary impact.

The Chevrolet's driver was a 57 year old male with a reported height/weight of 183 cm (72 in) and 86 kg (190 lb). He was restrained by the 3-point lap and shoulder belt. His only reported injuries were a displaced spiral fracture to the 4th metacarpal of the right hand (AIS 2) and neck/back strain (AIS 1). The right front passenger in the Chevrolet was a 48 year old female with reported height/weight of 155 cm (61 in) and 68 kg (150 lb). She was restrained by the 3-point lap and shoulder belt. Her reported injuries were multiple facial abrasions and contusions (AIS 1). Her left cornea was also abraded (AIS 1). These injuries were attributed to front passenger air bag contact.

18. *Key Words* Remote investigation Supplemental Restraint System Depowered air bag deployment		19. *Distribution Statement* General Public	
20. *Security Classif. (of this report)* Unclassified	21. *Security Classif. (of this page)* Unclassified	22. *No. of Pages* 4	23. *Price*

TABLE OF CONTENTS

BACKGROUND 1

SUMMARY 1

AIR BAG VEHICLE 2

DRIVER INJURIES 2

DRIVER KINEMATICS 3

RIGHT FRONT OCCUPANT INJURIES 3

RIGHT FRONT OCCUPANT KINEMATICS 3

CALSPAN REMOTE DEPOWERED AIR BAG DEPLOYMENT INVESTIGATION
VEHICLE: 1998 CHEVROLET LUMINA
CALSPAN CASE NO. CA98-01
LOCATION: PENNSYLVANIA
CRASH DATE: DECEMBER, 1997

BACKGROUND

This investigation focused on a three-vehicle crash that involved a 1998 Chevrolet Lumina, a 1998 Toyota Camry and a 1984 Pontiac Grand Prix. The Chevrolet Lumina and the Toyota Camry were both equipped with Supplemental Restraint Systems that consisted of depowered driver and front passenger air bag systems. Only the depowered air bag system of the Chevrolet Lumina deployed in the crash. The Chevrolet's two front occupants both sustained injuries in the crash, were transported to a local hospital for treatment and released. The National Highway Traffic Safety Administration (NHTSA) was informed of the crash by NASS PSU-06 on January 8, 1998. NHTSA assigned an investigative effort to the Calspan Special Crash Investigations Team on January 14, 1998. Initial investigation into the matter has revealed that the Chevrolet Lumina was repaired prior to case notification, therefore a remote investigative effort was conducted.

SUMMARY

This three-vehicle crash occurred in the early afternoon hours of December, 1997. At the time of the crash, it was daylight and the roads were dry; the weather was not a factor. The crash occurred near the mouth of a Y-type intersection formed by a four lane east/west road and an intersecting three lane road. The three lane road intersected from the northeast. Westbound traffic was heavy at the time of the crash caused by an intersection and bridge west of the crash scene. Traffic was stopped and backed up in the inboard westbound lane.

Immediately prior to the crash, the 1998 Chevrolet Lumina was driving west in the outboard lane of the road approaching the Y intersection. The driver indicated his speed was approximately 40-48 km/h (25-30 mph). A 1998 Toyota Camry traveling east in the inboard lane was stopped intending to turn left to the intersecting three lane road. The traffic, backed-up in the inboard westbound lane, separated allowing the Toyota to initiate the left turn. The Toyota emerged through the stopped traffic at an estimated 8 km/h (5 mph), directly in the path of the Chevrolet.

The driver of the Chevrolet initiated a clockwise steer input and braked in an attempt to avoid the Toyota. The police report indicated there was approximately 66 m (20 ft) of pre-impact skid marks. The left front of the Chevrolet struck the right front fender of the Toyota in an estimated 12 o'clock/2 o'clock impact configuration. The impact caused the air bag system in the Chevrolet to deploy. The estimated delta V of the crash was 16-19 km/h (10-12 mph). No photographs of the vehicles were available.

The Chevrolet's driver was a 57 year old male with a reported height/weight of 183 cm (72 in) and 86 kg (190 lb). He was restrained by the 3-point lap and shoulder belt. His only reported injuries were a

displaced spiral fracture to the 4th metacarpal of the right hand (AIS 2) and a sprain/strain of the upper back and neck (AIS 1). He indicated the fracture was caused by contact with the left center instrument panel. The driver wore prescription eye glasses which were deformed in the contact with the air bag, however there were no facial injuries. He had no recollection of the air bag deployment or air bag contact.

The right front passenger in the Chevrolet was a 48 year old female with reported height/weight of 155 cm (61 in) and 68 kg (150 lb). She was restrained by the 3-point lap and shoulder belt. Her reported injuries were multiple facial abrasions and contusions (AIS 1). Her left cornea was also abraded (AIS 1). Both of these injuries were attributed to front passenger air bag contact.

Upon separation from the Toyota, the Chevrolet slid to the northwest approximately 66 m (20 ft), coming to rest in the mouth of the intersection. The impact forces caused the Toyota to rotate counter-clockwise approximately 30 degrees. The rotation caused a secondary impact between the left front fender of the Toyota and the back plane of the 1984 Pontiac Grand Prix that was stopped in the inboard westbound traffic lane. The Chevrolet and Toyota both sustained disabling damage and were towed from the scene.

AIR BAG VEHICLE

The 1998 Chevrolet Lumina, 4 door sedan was identified by the VIN of 2G1WL52M4W9 (production sequence deleted). The vehicle was equipped with a Supplemental Restraint System (SRS) that consisted of depowered driver and front passenger air bags. The manual restraint consisted of 3-point lap and shoulder belts for the four outboard seating positions. The power train consisted of a 3.1 liter, V-6 engine linked to 4 speed automatic transmission.

Photographs of the vehicular damage were not available. The Chevrolet reportedly sustained damages totaling approximately $8000. The repair shop manager indicated the Chevrolet was struck on the left front causing structural damage to the left unitized frame rail. The additional components damaged included: the front bumper fascia and reinforcing bar, left front fender, left front suspension the left front headlight cluster and windshield. He further indicated that both front air bags were replaced as well as the clock spring for the driver air bag module. He also stated no repair was required for the steering column. In his interview, the driver indicated the right side of the windshield was fractured which he attributed to the front passenger air bag deployment.

DRIVER INJURIES

Injury	Severity (AIS 90)	Injury Mechanism
Displaced spiral fracture of the right 4th metacarpal	Moderate (752002.2,1)	Instrument panel
Neck strain	Minor (640278.1,6)	Impact force/restraint loading
Upper back strain	Minor (640478.1,6)	Impact force/restraint loading

DRIVER KINEMATICS

Immediately prior to the crash, the driver was seated and restrained in a presumed normal posture. The driver's seat was adjusted to a rear track position, reported as one notch forward of full rear. The tilt steering column was adjusted between the center and lowest position. The driver indicated he was driving with his hands positioned at the 2 o'clock/9 o'clock positions on the steering wheel rim. The driver initiated clockwise steer and braked as a result of the Toyota encroaching into his traffic lane. It is likely the driver "braced" for the impact.

At impact, the driver responded to the 12 o'clock direction of the impact force by exhibiting a forward trajectory loading the 3-point restraint and contacting the deployed driver air bag. The deployment of the air bag contacted the anterior aspects of the driver's forearms and displaced them from the steering wheel. This displacement coupled with his forward trajectory displaced his right hand into the left center of the instrument panel where the fracture of the 4th metacarpal occurred. The driver then rebounded back into the left front seat in an upright position. The inertial loading of the restraint and subsequent rebound caused the neck and upper back strain.

The driver was transported to a local hospital, where he was treated for his injuries and released the same day. The fractured metacarpal required surgery which was completed approximately 1 week post-crash.

FRONT PASSENGER INJURIES

Injury	Severity (AIS 90)	Injury Mechanism
Multiple facial abrasions	Minor (290202.1,0)	Deploying depowered passenger air bag
Multiple facial contusions	Minor (290402.1,0)	Deploying depowered passenger air bag
Left corneal abrasion	Minor (240602.1,2)	Deploying depowered passenger air bag

FRONT PASSENGER KINEMATICS

Immediately prior to the crash, the front passenger was seated in a presumed normal posture. She was restrained by the 3-point lap and shoulder belt and indicated her seat was adjusted to a position between forward and mid-track. She was aware of the impending collision and may have braced for the impact and turned her head to the right. Upon impact, the passenger initiated a forward trajectory in response to the 12 o'clock impact force, loaded the manual restraint and came in contact with the expanding air bag. Contact with the air bag caused the multiple facial abrasions and contusions and the left corneal abrasion. The nature of the injuries suggests contact with the expanding air bag occurred late in its expansion. Her initial "forward" position coupled with her forward kinematic pattern indicates the passenger's displacement likely reached the outer limit of the air bag's expansion zone.

The passenger rebounded back into the right front seat in an upright position. She was transported to a local hospital where she was treated and released the day of the crash. She sought follow-up treatment with her ophthalmologist. She reported the corneal abrasion had healed with no residual effects to her vision.