Certified Advanced 208-Compliant Air Bag Investigation/Multiple Vehicle
Dynamic Science, Inc./Case Number: DS06015
2006 Chevrolet Cobalt
Nebraska
April 2006

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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.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient Catalog No.
DS06015		

4. Title and Subtitle	5. Report Date
Certified Advanced 208-Compliant Air Bag Investigation	August 10, 2006
	6. Performing Organization Report No.

7. Author(s)	8. Performing Organization Report No.
Dynamic Science, Inc.	

9. Performing Organization name and Address	10. Work Unit No. (TRAIS)
Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401	11. Contract or Grant no. DTNH22-01-C-27002

12. Sponsoring Agency Name and Address	13. Type of report and period Covered
U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590	14. Sponsoring Agency Code

15. Supplemental Notes

16. Abstract

This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) air bag system in a 2006 Chevrolet Cobalt. The crash occurred within the confines of a four-leg intersection. The case vehicle was a 2006 Chevrolet Cobalt two-door coupe being driven by an unrestrained 17-year-old male. There was an unrestrained 17-year-old female passenger in the front right seat. The other vehicle was a 1999 Chevrolet Cavalier four-door sedan. The third vehicle was a 2005 Nissan Quest four-door minivan. The Cobalt was traveling south. The Cavalier was initially traveling northbound on the same two-way street and was stopped, waiting to turn left from lane three, a left-turn only lane. The Cavalier was stopped behind a sports utility vehicle (SUV) that was also turning left. The Nissan Quest was stopped, facing east, in the right curb lane on a five lane, two-way intersecting street. According to the police report, as the Cobalt entered the intersection, the SUV turned left across the Cobalt's travel path. The driver of the case vehicle reported that he slowed down as the SUV turned in front of him. After slowing for the turning vehicle, the driver of the Cobalt proceeded straight ahead as the Cavalier began its left turn. The front of the Cavalier struck the front left of the Cobalt. The impact resulted in the deployment of the Cobalt's driver and passenger frontal air bags. The dual front air bags in the Cavalier also deployed. After the initial impact, the Cobalt was deflected to the right, entered the western leg of the intersection and struck the left front of the stopped Quest. According to the police report, the drivers of the Cobalt and Cavalier were not injured. The front right passenger in the Cobalt sustained a "visible but not disabling" injury to her elbow/lower arm/hand. She did not receive any medical treatment on-scene and was not transported. The driver of the Quest sustained a possible neck injury but was not treated at the scene and was not transported. The Cobalt was towed from the scene due to damage and was later declared a total loss. The Cavalier was sold and the Quest was repaired.

17. Key Words	18. Distribution Statement
Air bag, deployment, injury, Certified Advanced 208 Compliant	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Form DOT F 1700.7 (8_72) Reproduction of this form and completed page is authorized

Dynamic Science, Inc.
Crash Investigation
Case Number: DS06015

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BACKGROUND

Description

This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) air bag system in a 2006 Chevrolet Cobalt. The multi-stage air bags were certified by the manufacturer to meet the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This three vehicle crash occurred in April 2006 at 1735 hours in an urban area of Nebraska. The crash occurred within the confines of a four-leg intersection. The case vehicle was a 2006 Chevrolet Cobalt two-door coupe being driven by an unrestrained 17-year-old male. There was an unrestrained 17-year-old female passenger in the front right seat. The other vehicle was a 1999 Chevrolet Cavalier four-door sedan being driven by a restrained 17-year-old male. The driver was the sole occupant. The third vehicle was a 2005 Nissan Quest four-door minivan being driven by a restrained 43-year-old male. There were two other occupants in the Quest, but their gender and ages are not known.

Figure 1. Front/Left - 2006 Chevrolet Cobalt

The Cobalt was traveling south in the curb lane on a five lane, two-way roadway. The Cavalier was initially traveling northbound on the same two-way street and was stopped, waiting to turn left from lane three, a left-turn only lane. The Cavalier was stopped behind a sports utility vehicle (SUV) that was also turning left. The Nissan Quest was stopped, facing east, in the right curb lane on a five lane, two-way intersecting street. According to the police report, as the Cobalt entered the intersection, the SUV turned left across the Cobalt's travel path. The driver of the case vehicle reported that he slowed down as the SUV turned in front of him. After slowing for the turning vehicle, the driver of the Cobalt proceeded straight ahead as the Cavalier began its left turn. The front of the Cavalier struck the front left of the Cobalt. The impact resulted in the deployment of the Cobalt's driver and passenger frontal air bags. The dual front air bags in the Cavalier also deployed. After the initial impact, the Cobalt was deflected to the right, entered the western leg of the intersection and struck the left front of the stopped Quest.

According to the police report, the drivers of the Cobalt and Cavalier were not injured. The front right passenger in the Cobalt sustained a "visible but not disabling" injury to her elbow/lower arm/hand. She did not receive any medical treatment on-scene and was not transported. The driver of the Quest sustained a possible neck injury but was not treated at the scene and was not transported. The Cobalt was towed from the scene due to damage and was later declared a total loss. The Cavalier was sold and the Quest was repaired.

This CAC case was identified within a group of potential cases provided to the NHTSA. DSI was assigned the case on July 13, 2006. Field work was completed the week of July 17, 2006. Data from the electronic data recorder was downloaded and is included as Attachment 2 to this report.

SUMMARY

Crash Site

This three vehicle crash occurred in April 2006 at 1735 hours in an urban area of Nebraska. The collision occurred within the confines of a four-leg intersection controlled by traffic signals. The northern leg of the intersection is comprised of two southbound, two northbound and one left-turn only lane. The southern leg of the intersection is also comprised of two southbound, two northbound and one left-turn only lane. The north and southbound lanes are divided by a raised concrete strip. The western leg of the intersecting roadway is comprised of two eastbound, two westbound and one left-turn only lane. Both roadways were comprised of concrete. At the time of the crash the outside temperature was 55 degrees and it was clear and dry. The speed limit for both roadways was 64 km/h (40 mph). This intersection is controlled by tri-color traffic signals.

Figure 2. Approach of case vehicle to intersection (south)

Figure 3. Approach of 1999 Chevrolet Cavalier to intersection (north)

Pre-Crash

The case vehicle was a 2006 Chevrolet Cobalt two door coupe being driven by an unrestrained 17-year-old male. There was an unrestrained 17-year-old female passenger in the front right seat. The Cobalt was traveling south in the curb lane and was approaching the intersection with a steady green light. The other vehicle was a 1999 Chevrolet Cavalier being driven by a restrained 17-year-old male. The Cavalier was initially northbound and was stopped, facing north, in the left hand turn lane, waiting to turn onto the intersecting roadway. The Cavalier was stopped behind a non-contact SUV that was also waiting to turn left. The third vehicle was a 2005 Nissan Quest minivan being driven by a restrained 43-year-old male. There was a restrained passenger in the front right seat and a child restrained in a child safety seat in the right rear seat. The gender and ages of these two passengers are not known. The minivan was stopped at the intersection facing east. As the Cobalt entered the intersection, the non-contact SUV turned left in front of the Cobalt.

Figure 4. Approach of 2005 Nissan Quest to intersection (east)

The driver of the Cobalt reported to police that he slowed for the turning SUV and then proceeded straight ahead. The Cavalier began its left turn after the SUV.

Crash

The front of the Cavalier struck the front left of the Cobalt (11FLEE6). The impact severity was moderate and resulted in the deployment of the Cobalt's driver and passenger front air bags. The dual front air bags in the Cavalier also deployed. The missing vehicle routine of the WinSmash program computed a total delta V of 11.0 km/h (6.8 mph) for the Cobalt. The longitudinal and lateral components were -8.4 km/h (-5.2 mph) and 7.1 km/h (4.4 mph), respectively. The Cobalt was deflected to the right, entered the western leg of the intersection and struck the left front of the stopped Quest. The damage to the case vehicle from this crash event overlapped the front left damage caused by the impact between the Cobalt and the Cavalier.

Post-Crash

According to the police report, the drivers of the Cobalt and Cavalier were not injured. The front right passenger in the Cobalt sustained a "visible but not disabling" injury to her elbow/lower arm/hand area. She did not receive any medical treatment on-scene and was not transported. The driver of the Quest sustained a possible neck injury but was not treated at the scene and was not transported. The Cobalt and the Cavalier were towed from the scene and the Cobalt was later declared a total loss. The Cavalier was sold and the Quest was repaired.

Vehicle Data - 2006 Chevrolet Cobalt LS Level 2

The 2006 Chevrolet Cobalt was identified by the Vehicle Identification Number (VIN): 1G1AK15F367xxxxxx. The Cobalt is a two door coupe with seating for five. The Cobalt was equipped with a 2.2 liter four cylinder engine, a four speed manual transmission, front wheel drive, four-wheel-disc ABS, daytime running lights, and a multi-function steering wheel including steering wheel mounted remote audio controls and a tilt adjustment.

The 2006 Chevrolet Cobalt was equipped with Continental Touring Contact AS P195/60R15 tires. The manufacturer's recommended cold tire pressure could not be determined because the left front door was jammed shut post-crash and the tire placard was inaccessible. The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Flat	8 mm (10/32 in)	Yes	Rim bent; tire debeaded
LR	214 kPa (31 psi)	8 mm (10/32 in)	No	None
RR	200 kPa (29 psi)	9 mm (11/32 in)	No	None
RF	228 kPa (33 psi)	8 mm (10/32 in)	No	None

The front row seating in the Cobalt was configured with dual fabric covered bucket seats with folding backs. The seats were equipped with adjustable head restraints that were not damaged. Both front seats had plastic seat belt positioning devices attached near the bottom portion of the head restraints. The driver's seat belt positioning device broke off when the left front belt pretensioner actuated. The second row was configured as a fabric covered bench seat with folding backs. The two outboard second row seating positions were equipped with adjustable head restraints that were not damaged.

Vehicle Damage

Exterior Damage - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt sustained moderate front end damage as a result of the impact with the Chevrolet Cavalier and the Nissan Quest. The case vehicle sustained 23.0 cm (9.1 in) of direct damage along the front bumper beginning at the left front bumper corner, extending to the right. The direct contact extended 143.0 cm (56.3 in) down the left side of the vehicle. The left front tire was restricted, the tire was debeaded, and the rim was damaged. The left wheelbase was shortened by 8.0 cm (3.1 in). Six crush measurements were documented along the front bumper as follows: C1=3.0 cm (1.2 in), C2=2.0 cm (0.8 in), C3=1.0 cm (0.4 in), C4=0.0 cm (0.0 in), C5=0.0 cm (0.0 in), C6=0.0 cm (0.0 in). The Collision Deformation Classification (CDC) for the impact with the Cavalier was 11FLEE6. The EDR reported estimated principle direction of force was 320 degrees. The damage caused by the impact between the Cobalt and the Quest overlapped with the damage from the first crash event and could only be classified with a partial CDC. The second collision event is likely to have been minor in nature. The Quest was able to be driven away from the crash scene. The Cobalt's electronic data recorder reported that the event recording was complete; it did not record the non-deployment (i.e., 2nd) crash event.

CDC:	Impact 1: 11FLEE6 Impact 2: 12F9999	
Delta V (Impact 1):	Total	11.0 km/h (6.8 mph)
	Longitudinal	-8.4 km/h (-5.2 mph)
	Latitudinal	7.1 km/h (4.4 mph)
	Energy	7,714 joules (5,690 ft lbs)

Figure 5. Front - 2006 Chevrolet Cobalt

Figure 6. Left front damage - 2006 Chevrolet Cobalt

Interior Damage - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt sustained minor interior damage due to normal air bag deployment related damage.

The driver and right front B pillar seat belt pretensioners actuated during the first crash event and were locked in the stowed position post-crash. The driver's plastic seat belt positioning device broke when the retractor pretensioner activated.

There was no intrusion and no integrity loss. The windshield was cracked near the rearview mirror. It is possible that the unrestrained right front passenger may have contacted the rearview mirror with her left lower arm and/or hand, causing the mirror to rotate left and impact the windshield. There was also damage in the lower right section of the windshield due to contact from the deploying passenger front air bag cover flap. The right front door remained closed and operational. The left front door was jammed shut due to damage.

Figure 7. Front row - 2006 Chevrolet Cobalt

Figure 8. Broken left front seat belt positioning device (belt not in use at time of crash)

Manual Restraint Systems - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt was configured with manual 3-point lap and shoulder belts for each of the five seating positions. Both front seat belts were equipped with B-pillar pretensioners with load limiters and seat belt positioning devices. Neither belt had anchorage adjustments. Both pretensioners actuated during the first collision event and were locked in the stowed position post-crash. Both safety belts were configured with sliding latch plates. The retractor types could not be determined during the inspection because the belts were locked in place. An exemplar vehicle was used to determine the front row retractor types. The driver's safety belt had an emergency locking retractor (ELR). The right front seat belt had a switchable ELR/automatic locking retractor. The second row seating positions were equipped with sliding latch plates and switchable emergency locking/automatic locking retractors.

Figure 9. Intact right front seat belt positioning device (for comparison)

All three second row seating positions were equipped with the lower anchor and tether points that are part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. The tether anchor points were located on the hat shelf behind the second row seat backs.

Supplemental Restraint Systems - 2006 Chevrolet Cobalt

The Chevrolet Cobalt was equipped with advanced occupant protection systems. The systems consists of the Sensing and Diagnostic Module (SDM), which consist of dual stage driver and front right passenger "intelligent" Certified Advanced 208-Compliant air bags, including a passenger occupant sensor. The multi-stage air bags were certified by the manufacturer to meet the requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The occupant sensors are designed to detect the presence of a properly seated occupant and determine if the passenger's frontal air bag should be deployed or not. In certain conditions the passenger sensing system will turn off the right front air bag. The air bag system will monitor the severity of a collision and will inflate the air bags based on whether or not the seat belts are in use. The system is controlled by the SDM. The primary function of the SDM is to control the deployment of the occupant protection systems. The system records the vehicle's forward velocity change.

For Deployment Events and Deployment Level Events, the SDM will record 220 milliseconds of data after the deployment criteria is met and up to 70 milliseconds of data before the deployment criteria is met. For Non-Deployment events, the SDM will record up to the first 300 milliseconds of data after algorithm enable. The minimum SDM Recorded Vehicle Forward Velocity change that is needed to record a Non-Deployment event is 8 km/h (5 mph). The SDM data was downloaded using the Vetronix Crash Data Retrieval System.

One Deployment Event was recorded by the SDM. The Deployment Event occurred as a result of the impact with the Chevrolet Cavalier. The Vetronix system status at deployment report indicates that:

1. SIR warning lamp status was OFF.
2. The driver's belt switch status was UNBUCKLED.
3. The passenger's belt switch status was UNBUCKLED.
4. Ignition cycles at deployment = 128
5. Ignition cycles at investigation = 140
6. Number of ignition cycles SIR Warning Lamp was ON/OFF continuously = 127
7. Maximum SDM recorded longitudinal velocity change -20.73 km/h (-12.88 mph).
8. Maximum SDM recorded lateral velocity change 16.37 km/h (10.17 mph).
9. Driver first stage time algorithm enabled (AE) to deployment command criteria met was 38 milliseconds.
10. Driver second stage time algorithm enabled to deployment command criteria met was 54 milliseconds.
11. Passenger first stage time algorithm enabled to deployment command criteria met was 38 milliseconds.
12. Passenger second stage time algorithm enabled to deployment command criteria met was 54 milliseconds.
13. Time between non-deployment and deployment events = N/A.
14. Estimated Principal Direction of Force (PDOF) degrees = 320

15. Event recording complete = YES.
16. The vehicle speed was 74 km/h (46 mph) five seconds before AE and decelerated to 56 km/h (35 mph) at 1 second before AE.
17. The brake switch status was OFF from 5 through 1 seconds before AE.

The Cobalt was not equipped with side impact air bags or side curtains.

As a result of the longitudinal deceleration of the Cobalt during the impact with the Cavalier, the driver and right front passenger air bags deployed and the seat belt pretensioners actuated.

Figure 10. Deployed driver's front air bag

The driver's air bag deployed from the center of the steering wheel hub through symmetrical I-configuration cover flaps. Each flap measured 9.0 cm (3.5 in) wide and had two 2.0 cm (0.8 in) high facets surrounding a semi-circular cutout located in the center of the cover flaps. The deployed driver air bag measured 56.0 cm (22.0 in) in diameter in its deflated state. The air bag was tethered by a single internal strap and there were two circular vent ports located at the 11 and 1 o'clock positions on the rear of the air bag. There was no damage or occupant contact visible on either the cover flap or air bag, although it is likely that the unrestrained driver contacted the bag during the first crash event.

Figure 11. Deployed passenger front air bag

The passenger front air bag deployed from a top mounted single air bag module cover flap. The cover flap was generally rectangular in shape and measured 30.0 cm (11.8 in) wide along the top of the cover flap and 31.0 cm (12.2 in) wide along the bottom of the flap. The left side of the cover flap measured 22.0 cm (8.7 in) high and the right side measured 14.0 cm (5.5 in) high. The cover flap was slightly deformed, which likely occurred during the deployment. The air bag had a rectangular shape and measured 43.0 cm (16.9 in) seam to seam laterally and 64.0 cm (25.2 in) in height in its deflated state. The air bag had a maximum excursion of 57.0 cm (22.4 in) in its deflated state. There was one internal tether at the center of the bag and two circular vent ports on the sides of the air bag at the 3 and 9 o'clock positions. There was no occupant contact evidence visible on the cover flap and air bag, although it is likely that the unrestrained right front passenger contacted the bag during the first crash event.

Vehicle Data - 1999 Chevrolet Cavalier

Description:	1999 Chevrolet Cavalier 4-door sedan	
VIN:	1G1JC5248X7xxxxxx	
Odometer:	Unknown	
Engine:	2.2L, 4 cylinder	
Reported Defects:	None	
Cargo:	Unknown	
Damage Description:	Front end damage per the police report	
CDC:	Unknown	
Delta V:	Total	12.0 km/h (7.5 mph)
	Longitudinal	-11.8 km/h (7.3 mph)
	Latitudinal	-2.1 km/h (1.3 mph)
	Energy	9,688 joules (7,146 ft lbs)

Vehicle Data - 2005 Nissan Quest

Description:	2005 Nissan Quest 4-door minivan	
VIN:	5N1BV28U35Nxxxxxx	
Odometer:	Unknown	
Engine:	3.5L, 6 cylinder	
Reported Defects:	None	
Cargo:	Unknown	
Damage Description:	Left/Front end damage per the police report	
CDC:	Unknown	
Delta V:	Total	Unknown
	Longitudinal	Unknown
	Latitudinal	Unknown
	Energy	Unknown

Occupant Demographics - 2006 Chevrolet Cobalt

	Driver	Occupant 2
Age/Sex:	17/Male	17/Female
Seated Position:	Front left	Front right
Seat Type:	Fabric covered bucket seat	Fabric covered bucket seat
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Occupation:	Unknown	Unknown
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	Not Applicable
Driving Experience:	Presumed to be <3 years	Not Applicable
Body Posture:	Presumed to be upright, forward facing	Presumed to be upright, forward facing
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Manual 3-point lap and shoulder belt available - not used	Manual 3-point lap and shoulder belt available - not used
Air bag:	Front air bag available - deployed.	Front air bag available - deployed.

Occupant Demographics - 1999 Chevrolet Cavalier

	Driver
Age/Sex:	17/Male
Seated Position:	Front left
Seat Type:	Unknown
Height:	Unknown
Weight:	Unknown
Occupation:	Unknown
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	None
Driving Experience:	Presumed to be <3 years
Body Posture:	Presumed to be upright, forward facing
Hand Position:	Presumed to be on the wheel, actively steering while executing a left turn
Foot Position:	Presumed to be on the foot control(s) and/or floorboards
Restraint Usage:	Lap and shoulder belt used per the police report

Occupant Demographics - 2005 Nissan Quest

	Driver	Occupant 2	Occupant 3
Age/Sex:	43/Male	Unknown	Unknown
Seated Position:	Front left	Front right	Second row right
Seat Type:	Unknown	Unknown	Unknown
Height:	Unknown	Unknown	Unknown
Weight:	Unknown	Unknown	Unknown
Occupation:	Unknown	Unknown	Not Applicable
Pre-existing Medical Condition:	None noted	None noted	None noted
Alcohol/Drug Involvement:	None	Not Applicable	Not Applicable
Driving Experience:	Unknown	Not Applicable	Not Applicable
Body Posture:	Unknown	Unknown	Unknown
Hand Position:	Unknown	Unknown	Unknown
Foot Position:	Unknown	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used per the police report.	Lap and shoulder belt used per the police report.	Child safety seat used per the police report

Occupant Injuries - 2006 Chevrolet Cobalt

Driver: Not injured, per the police report.

Front Right Occupant: Injuries obtained from the police report. This occupant sustained a "visible but not disabling" injury to her elbow/lower arm/hand area. She did not receive any medical treatment on-scene and was not transported.

Occupant Injuries - 1999 Chevrolet Cavalier

Driver: Not injured, per the police report.

Occupant Injuries - 2005 Nissan Quest

Driver: Injuries obtained from the police report. The driver sustained a possible neck injury but was not treated at the scene and was not transported.

Front Right Occupant: Not injured, per the police report.

Second Row Right Occupant: Not injured, per the police report.

Occupant Kinematics - 2006 Chevrolet Cobalt

Driver Kinematics

The 17-year-old male driver appears to have been seated in an upright posture in the fabric covered bucket seat and was not restrained by the available 3-point manual lap and shoulder belt. The seat was adjusted to the rearward most track position. The seat back was reclined at a 73 degree angle and the seat bottom had a 13 degree angle. During the initial impact, the driver's front air bag deployed and the left side safety belt pretensioner actuated, although the belt was not in use at the time. The male driver initiated a forward and slightly lateral trajectory towards the 11 o'clock direction of force, likely contacting the deploying driver air bag with his face. The case vehicle was deflected to the right from the impact, entered the western leg of the intersection and struck the left front of the stopped Nissan Quest. According to the police report, this driver was not injured and did not receive any medical treatment at the scene.

Figure 12. Driver's seating area

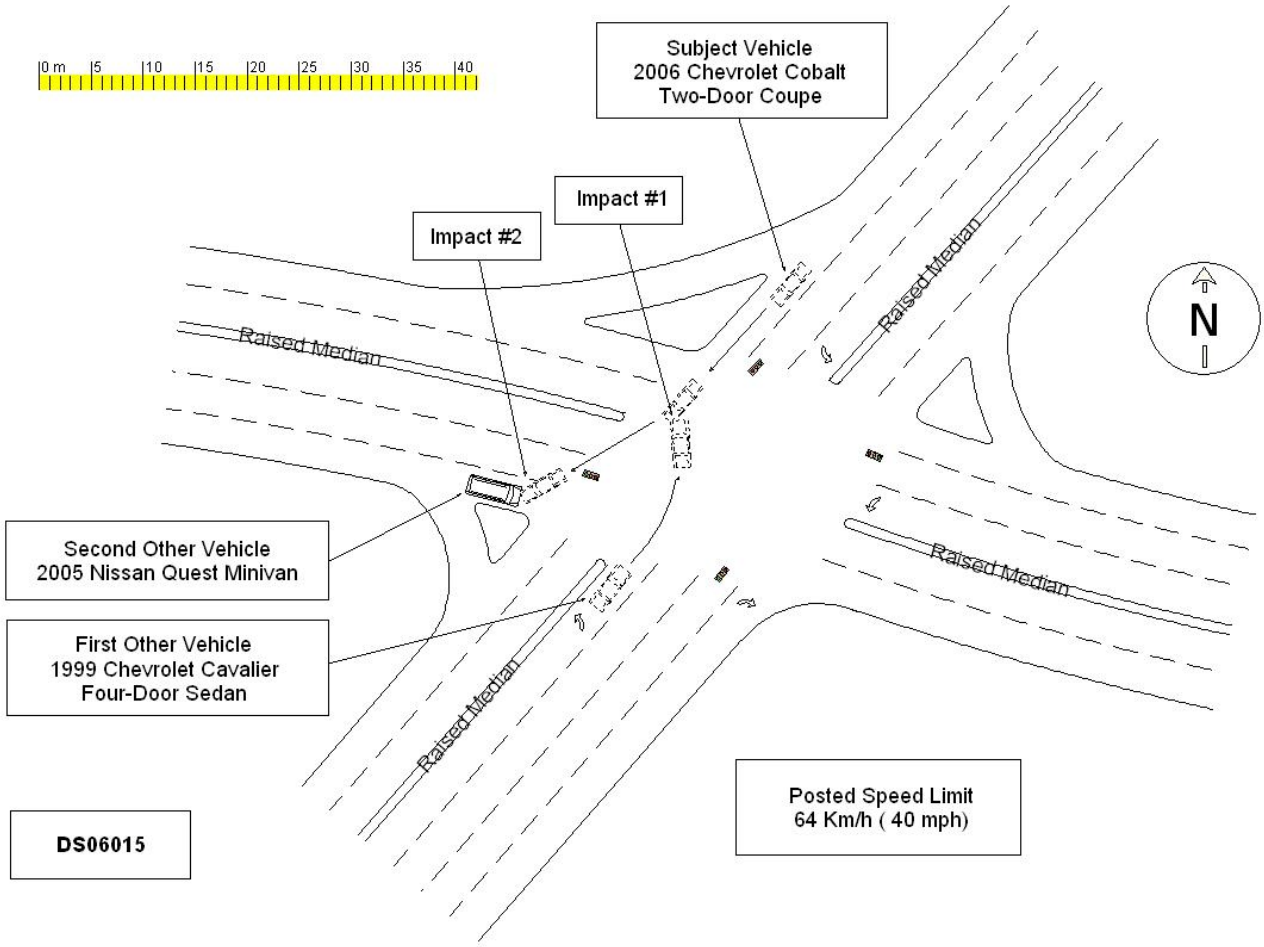
Front Right Occupant Kinematics

The 17-year-old female passenger appears to have been seated in an upright posture in the fabric covered bucket seat and was not restrained by the available 3-point manual lap and shoulder belt. The seat was adjusted to the center track position. The seat back was reclined at a 74 degree angle and the seat bottom had a 13 degree angle. During the initial impact, the passenger's front air bag deployed and the right side safety belt pretensioner actuated, although the belt was not in use at the time. The female passenger initiated a forward and slightly lateral trajectory towards the 11 o'clock direction of force, likely contacting the deploying passenger air bag. She may have contacted the rearview mirror with her left hand or lower left arm, pushing the mirror into the windshield, cracking it. The case vehicle was deflected to the right from the impact, entered the western leg of the intersection and struck the left front of the stopped Nissan Quest. According to the police report, this passenger sustained a visible injury to her elbow/lower arm/hand but she did not receive any medical treatment at the scene and was not transported.

Figure 13. Front right passenger's seating area

Figure 14. Possible occupant contact to rearview mirror

Attachment 1. Scene Diagram



Attachment 2. Vetronix Report

Vetronix

CDR CRASH DATA RETRIEVAL SYSTEM

CDR File Information

Vehicle Identification Number	1G1AK15F367******
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	06015 WITHOUT SEQUENTIAL NUMBER.CDR
Saved on	Monday, July 17 2006 at 06:19:05 AM
Collected with CDR version	Crash Data Retrieval Tool 2.800
Collecting program verification number	9238B95E
Reported with CDR version	Crash Data Retrieval Tool 2.800
Reporting program verification number	9238B95E
Interface used to collected data	Block number: 00 Interface version: 4A Date: 11-08-05 Checksum: 7500
Event(s) recovered	Deployment

SDM Data Limitations

SDM Recorded Crash Events:
There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). It can contain Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded vehicle forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 250 times.
The second type of SDM recorded crash event is the Deployment Event. It also can contain Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. Deployment Events cannot be overwritten or cleared from the SDM. Once the SDM has deployed the air bag, the SDM must be replaced.
The data in the Non-Deployment Event file will be locked after a Deployment Event, if the Non-Deployment Event occurred within 5 seconds before the Deployment Event unless a Deployment Level Event occurs within 5 seconds after the Deployment Event, then the Deployment Level Event will overwrite the Non-Deployment Event file.

SDM Data Limitations:
-SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Forward Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change. For Deployment Events and Deployment Level Events, the SDM will record 220 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record up to the first 300 milliseconds of data after algorithm enable. The minimum SDM Recorded Vehicle Forward Velocity Change, that is needed to record a Non-Deployment Event, is 5 MPH.
-Maximum Recorded Vehicle Velocity Change is the maximum recorded velocity change in the vehicle's combined "X" and "Y" axis.
-Calculated Principal Direction of Force (PDOF) is the arctangent of the maximum observed lateral velocity change divided by the maximum observed longitudinal velocity change. PDOF is displayed where zero degrees is located at the front of the vehicle, with 90 degrees is displayed to the right side of the vehicle and so on, clockwise around the vehicle.
-Event Recording Complete will indicate if data from the recorded event has been fully written to the SDM memory or if it has been interrupted and not fully written.
-SDM Recorded Vehicle Speed accuracy can be affected if the vehicle has had the tire size or the final drive axle ratio changed from the factory build specifications.
-Brake Switch Circuit Status indicates the status of the brake switch circuit.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if the SDM receive an invalid message from the module sending the pre-crash data.
-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit. The Passenger Belt Switch Circuit Status for 2006 Chevrolet Cobalt Sport Coupe (AP) model vehicles, with the option package that includes Recaro brand seats (RPO ALV), will always report a default value of "Buckled".
-The Time Between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than 5 seconds, "N/A" is displayed in place of the time. If the value is negative, then the Deployment Event occurred first. If the value is positive, then the Non-Deployment Event occurred first.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-The ignition cycle counter relies upon the transitions through OFF->RUN->CRANK power-moding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the ignition counter.

SDM Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Status Data (Pre-Crash) is transmitted to the SDM, by various vehicle control modules, via the vehicle's communication network.
-The Belt Switch Circuit is wired directly to the SDM.

System Status At AE

Vehicle Identification Number	**1AK15F*6*******
Low Tire Pressure Warning Lamp (If Equipped)	Invalid
Vehicle Power Mode Status	Run
Remote Start Status (If Equipped)	Inactive
Run/Crank Ignition Switch Logic Level	Active
Brake System Warning Lamp (If Equipped)	OFF

System Status At 1 second

Transmission Range (If Equipped)	Third Gear
Transmission Selector Position (If Equipped)	Fourth Gear
Traction Control System Active (If Equipped)	Invalid
Service Engine Soon (Non-Emission Related) Lamp	OFF
Service Vehicle Soon Lamp	OFF
Outside Air Temperature (degrees F) (If Equipped)	55.4
Left Front Door Status (If Equipped)	Closed
Right Front Door Status (If Equipped)	Closed
Left Rear Door Status (If Equipped)	Unused
Right Rear Door Status (If Equipped)	Unused
Rear Door(s) Status (If Equipped)	Closed

Pre-crash data

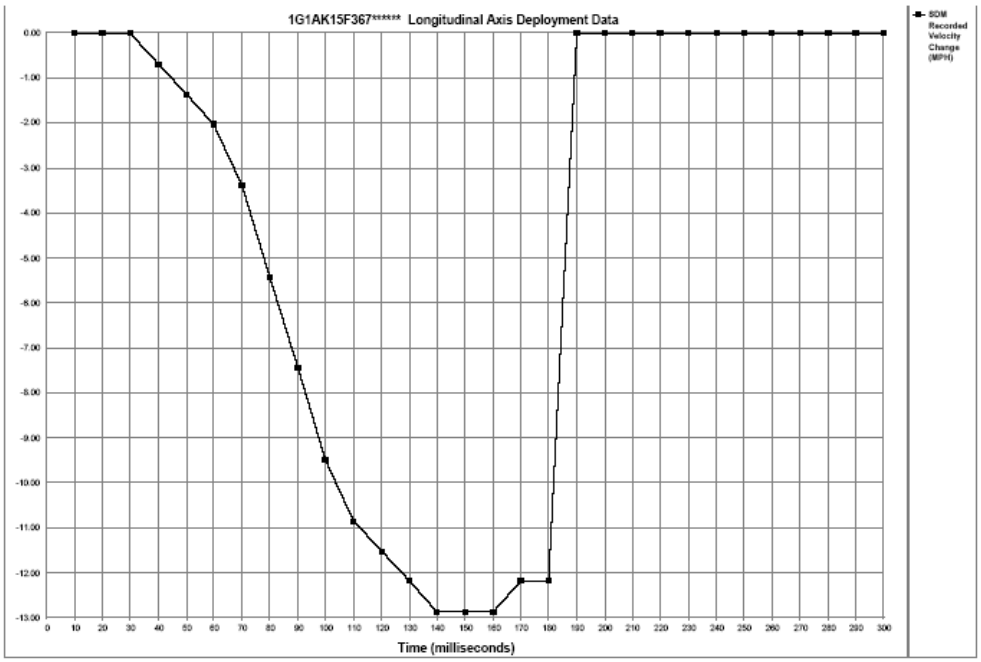
Parameter	-2 sec	-1 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	Invalid	Invalid
Cruise Control Resume Switch Active (If Equipped)	Invalid	Invalid
Cruise Control Set Switch Active (If Equipped)	Invalid	Invalid

Pre-crash data

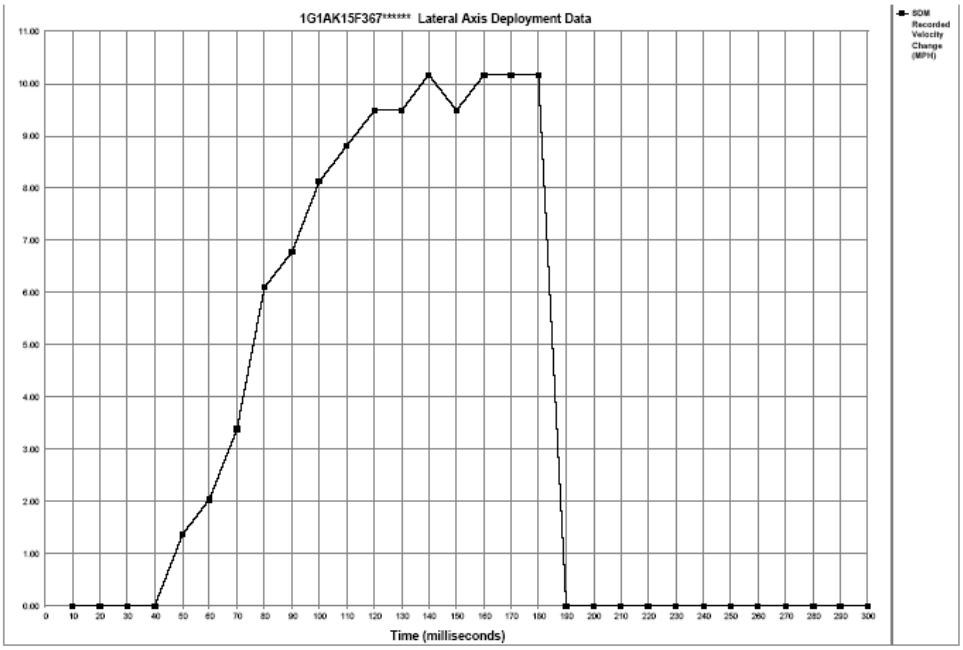
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	46	47	45	44	35
Engine Speed (RPM)	4160	3008	1472	1536	1536
Percent Throttle	57	21	16	18	15
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	OFF
Accelerator Pedal Position (percent)	50	0	0	0	0
Antilock Brake System Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Lateral Acceleration (feet/s²)(If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Yaw Rate (degrees per second) (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Steering Wheel Angle (degrees) (If Equipped)	0	0	0	0	0
Vehicle Dynamics Control Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid

System Status At Deployment

Ignition Cycles At Investigation	140
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	93400
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	127
Ignition Cycles At Event	128
Ignition Cycles Since DTCs Were Last Cleared	125
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Automatic Passenger SIR Suppression System Validity Status at AE	Valid
Automatic Passenger SIR Suppression System Status at AE	Air Bag Not Suppressed
Automatic Passenger SIR Suppression System Validity Status at First Deployment Command	Valid
Automatic Passenger SIR Suppression System Status at First Deployment Command	Air Bag Not Suppressed
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	38
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	54
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	38
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	54
Time Between Events (sec)	N/A
Driver First Stage Deployment Loop Commanded	Yes
Driver Second Stage Deployment Loop Commanded	Yes
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	Yes
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	Yes
Passenger Second Stage Deployment Loop Commanded	Yes
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	Yes
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Third Row Right Roof Rail/Head Curtain Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Multiple Event Counter	0
An Event(s) Preceded the Recorded Event(s)	No
An Event(s) was in Between the Recorded Event(s)	No
An Event(s) Followed the Recorded Event(s)	No
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	No
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes
Estimated Principal Direction of Force (PDOF) degrees	320



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Longitudinal Axis Recorded Velocity	0.00	0.00	0.00	-0.68	-1.36	-2.03	-3.39	-5.42	-7.46	-9.49	-10.85	-11.52	-12.20	-12.88	-12.88
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-12.88	-12.20	-12.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	1.36	2.03	3.39	6.10	6.78	8.13	8.81	9.49	9.49	10.17	9.49
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	10.17	10.17	10.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hexadecimal Data

This page displays all the data retrieved from the air bag module.
It contains data that is not converted by this program.

```
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$02  30 00 00 00 00 00 00
$03  02 00 00 00 00 00 00
$04  02 00 00 00 00 00 00
$05  00 00 00 00 00 00 00
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$07  00 49 00 00 00 00 00
$08  00 FF 00 00 00 00 00
$09  03 14 7E 00 00 00 00
$0A  00 00 00 00 00 00 00
$0B  00 00 04 0F 00 00 00
$0C  00 00 00 00 00 00 00
$0D  00 00 40 00 00 00 00
$0E  00 00 00 00 00 00 00
$0F  A0 00 00 00 00 00 00
$10  47 31 41 4B 31 35 46
$11  33 36 37 37 37 34 39
$12  30 32 00 00 00 00 00
$13  00 00 00 00 00 00 00
$14  00 00 00 00 00 00 00
$15  00 00 00 00 00 00 00
$16  03 06 0C 16 34 00 00
$17  07 07 07 07 00 00 00
$18  07 07 00 00 00 00 00
$19  07 07 00 00 00 00 00
$1B  3F 00 00 67 00 7A 00
$1C  3F 00 00 02 00 1A 00
$1D  00 00 00 00 00 00 00
$1E  4F 00 00 4F 00 01 00
$1F  33 C1 00 00 00 23 00
$20  40 00 00 00 00 00 00
$21  FF FF 00 00 50 00 00
$22  00 A7 00 00 00 00 00
$24  00 00 00 00 00 00 00
$25  00 00 00 00 00 00 00
$26  00 00 00 00 00 00 00
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$2E  80 00 2B 00 08 00 00
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$31  00 00 00 00 80 00 00
$32  00 00 00 80 00 00 00
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$34  18 18 17 2F 41 00 00
$35  38 47 49 4C 4A 00 00
$36  00 00 00 00 00 00 00
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$38  6A 00 00 00 03 C0 00
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$3B  03 06 0C 00 00 00 00
$3C  00 00 00 00 00 00 C0
$3D  31 41 4B 31 35 46 00
$3E  36 77 49 02 00 00 00
$3F  00 00 90 00 00 00 00
$40  00 00 00 00 00 00 00
$41  F8 F8 90 00 00 00 00
$42  80 FF FF FF FF 00 00
```

```
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$44  FF FF FF FF FF FF 00
$45  FF FF FF FF FF FF 00
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$4B  FF FF FF FF FF FF 00
$4C  FF FF FF FF FF FF 00
$4D  FF FF FF FF FF FF 00
$4E  FF FF FF FF FF FF 00
$4F  FF FF FF FF FF FF 00
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$52  81 FF FF FF 00 00 00
$53  FF FF FF 00 00 00 00
$54  82 FF FF 00 00 00 00
$55  FF FF FF FF FF FF 00
$67  A0 A5 00 00 00 00 00
$68  D0 D0 00 00 00 00 00
$69  00 24 7C 00 7F 00 00
$6A  7D 00 80 00 00 00 00
$6B  00 00 00 00 00 00 00
$6C  00 00 00 00 00 00 00
$6D  00 00 00 00 00 00 00
$6E  00 00 00 00 00 00 00
$6F  00 FF 02 FE 03 FD 00
$70  05 FB 09 F8 0A F5 00
$71  0C F2 0D F0 0E EF 00
$72  0E EE 0F ED 0E ED 00
$73  0F ED 0F EE 0F EE 00
$74  00 00 00 00 00 00 00
$75  00 00 00 00 00 00 00
$76  00 00 00 00 00 00 00
$77  00 00 00 00 00 00 00
$78  50 00 00 00 00 00 00
$79  01 00 00 00 00 00 00
$7A  02 00 00 00 00 00 00
$7B  13 1B 13 1B 00 00 00

$01  41 55 01 02 03 04 52 53 41 32 03 09 01 AA AA 01
$02  01 02 03 04
$03  41 54 01 02 03 04 52 53 41 32 03 09 01 AA AA 01
$04  01 02 03 04
$05  42 55 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
$06  FF FF FF FF
$07  42 54 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
$08  FF FF FF FF
$0D  41 48 32 39 35 31 52 35 33 30 30 31 34 58 45 4D
$0E  01 5A 4B 31
$0F  41 4A 01 02 03 04 52 45 41 32 30 32 33 30 30 30
$10  01 02 03 04
$13  42 52 30 31 33 34 56 31 06 30 30 36 47 55 46 47
$14  01 5A 74 02
$17  42 54 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
$18  FF FF FF FF
$21  33 19 2A B4 E6 87 91 9A
$22  90 11
$23  31 41 FA FA FA FA FA
$24  31 41 FA FA FA FA FA
$25  32 41 FA FA FA FA FA
$26  32 41 FA FA FA FA FA
$40  00 00
$41  3F 00 00 02 00 1A
$42  F0 C4
$43  00 00 8E 80
```

```
$44  C6 00 00 FC C0 C0
$45  07 01 07 01 05 01
$46  FF 1A 1A 64 64
$47  0A 64 06 04 04 05 0A 06 04 0A 00 00 FA 00 00 FF 04 64
$48  18 08 08
$B0  58
$B1  FD FE 00
$B2  FF FF FF FF FF
$B4  41 53 39 30 31 31 32 31 34 41 42 38 20 20 20 20
$B7  50 AA 04 0F 03
$B8  41 57 68 09 19
$C1  30 46 30 33
$CA  30 46 30 33
$CB  01 5A D1 33
$CC  01 5A D1 33
$D1  00 00
$DB  00 00
$DC  00 00
```