TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER

Advanced Information Engineering Services
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ON-SITE FRONTAL AIR BAG NON-DEPLOYMENT CRASH INVESTIGATION

VEHICLE: 2003 FORD CROWN VICTORIA POLICE INTERCEPTOR

CASE NO: CA04-024

LOCATION: OHIO

CRASH DATE: APRIL, 2004

Contract No. DTNH22-01-C-17002

Prepared for:

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Washington, D.C. 20590

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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.

TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract This on-site investigation focused on the crash severity and the cause of the non-deployment of the frontal air bags in a 2003 Ford Crown Victoria. The Ford was equipped with an Advanced Occupant Protection System (AOPS) that consisted of the integrated use of 3-point safety belts, safety belt buckle switch sensors, retractor pretensioners, driver seat position sensing and dual-stage frontal air bag inflation. The driver and front right passenger air bags were designed to deploy at different thresholds of crash severity dependant on manual restraint use and driver seat position. The Ford Crown Victoria was equipped with the Police Interceptor Package and was responding to an emergency at the time of the crash. The crash occurred when the driver lost directional control of the vehicle at the exit of a right curve on wet pavement. The vehicle initiated a counterclockwise rotation and struck a tree with its front plane. The 31 year old male driver and 27 year old male front right passenger were unrestrained at the time of the crash. The occupants of the vehicle were not injured. Reportedly, neither the retractor pretensioners nor frontal air bags deployed in the crash.			
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TABLE OF CONTENTS

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GENERAL DYNAMICS CASE NO: CA04-024

VEHICLE: 2003 FORD CROWN VICTORIA POLICE INTERCEPTOR
LOCATION: OHIO
CRASH DATE: APRIL, 2004

BACKGROUND

This on-site investigation focused on the crash severity and the cause of the non-deployment of the frontal air bags in a 2003 Ford Crown Victoria. The Ford was equipped with an Advanced Occupant Protection System (AOPS) that consisted of the integrated use of 3-point safety belts, safety belt buckle switch sensors, retractor pretensioners, driver seat position sensing and dual-stage frontal air bag inflation. The driver and front right passenger air bags were designed to deploy at different thresholds of crash severity dependant on manual restraint use and driver seat position. The Ford Crown Victoria was equipped with the Police Interceptor Package and was responding to an emergency at the time of the crash. The crash occurred when the driver lost directional control of the vehicle at the exit of a right curve on wet pavement. The vehicle initiated a counterclockwise rotation and struck a tree with its front plane. The 31 year old male driver and 27 year old male front right passenger were unrestrained at the time of the crash. The occupants of the vehicle were not injured. Reportedly, neither the retractor pretensioners nor frontal air bags deployed in the crash.

Figure 1: Front view of the 2003 Ford CVPI.

This crash was reported to the Office of Defects Investigation (ODI) of the National Highway Traffic Safety Administration (NHTSA) by a fleet manager stationed at the police motor pool. ODI subsequently requested that the Crash Investigation Division of the NHTSA assign an on-site investigation of the crash to the Special Crash Investigations team at General Dynamics. The case was assigned on May 5, 2004. The vehicle was being held in the motor pool pending the SCI investigation. The crash data stored within the vehicle's Restraint Control Module (RCM) was downloaded as a supplement to the investigation. The subject vehicle was inspected May 10, 2004.

SUMMARY

Crash Site

This single-vehicle crash occurred during the nighttime hours in April, 2004. At the time of the crash, it was dark and the roadway was illuminated by street lights. The weather was rain and the road surface was wet. The crash occurred on the southbound lane of a two lane asphalt road at the exit of a shallow right curve. The urban residential street was bordered by 15 cm (6 in) curbs and sidewalks. The road was lined by mature trees. The point of impact was a 36 cm (14

in) diameter maple tree located 15.0 m (49.3 ft) south of the end of the curve and 1.2 m (4.0 ft) west (right) of the curb. This road originated at a three leg intersection that was located 67 m (220 ft) north of the point of impact. The speed limit in the area of the crash was 40 km/h (25 mph). **Figure 2** is a southbound trajectory view approaching the point of impact. **Figure 3** is an on-scene police photograph of the Ford at final rest.

Figure 3: Southbound trajectory view.

Figure 2: Final rest position.

Crash Sequence

Pre-Crash

Prior to the crash, the 2003 Ford Crown Victoria Police Interceptor was parked on the roadside approximately 0.40 km (0.25 mile) from the crash site. The vehicle was occupied by a 31 year old male driver and a 27 year old male front right passenger. Both occupants were on-duty police officers and were in the process of writing an incident report. Neither occupant was wearing the manual 3-point safety belt system. The police dispatch contacted this police unit requesting their response to another officer in need of assistance. The police officer driver activated the vehicle's emergency lights and siren and entered the roadway. The Ford traveled through the intersection north of the crash site and turned left (southward) onto the subject road. The Ford was exiting the shallow right curve when the rear tires of the vehicle lost traction and the vehicle initiated a clockwise rotation The driver estimated his speed to be 24 to 32 km (15 to 20 mph). No pre-crash tire marks were documented at the time of the police investigation and there was no evidence of tire marks identified during the SCI scene inspection.

Crash

Figure 12, at the end of this narrative report, is a schematic of the crash. The vehicle rotated approximately 45 degrees clockwise and departed the right side of the road. The vehicle mounted the curb and the center aspect of the vehicle's frontal plane struck the tree resulting in moderate severity disabling damage. The impact's principle direction of force was in the 10 o'clock sector, an estimated 310 degrees. The impact with the tree stopped the vehicle's forward momentum. The Ford then rebounded off the tree and rotated an additional 70 degrees coming to rest. The Ford came to rest facing northwestward in the southbound lane. The safety belt

pretensioners and frontal air bags were not commanded to deploy. The delta V of the impact calculated by the Barrier Algorithm of the WINSMASH model was 20.3 km/h (12.6 mph). The longitudinal and lateral delta V components were -13.0 km/h (-8.1 mph) and 15.5 km/h (9.6 mph), respectively. The longitudinal delta V recorded by the vehicle's Restraint Control Module (RCM) was -10.9 km/h (-6.8 mph).

Post-Crash

The police officer driver and front right passenger exited the vehicle under their own power and were not injured in the crash. The driver notified the police dispatch of the crash and an investigator responded to the scene. The subject vehicle was towed back to the motor pool due to the disabling frontal damage. The fleet manager in charge of the motor pool reviewed the circumstances of the crash and was concerned that neither the safety belt pretensioners nor the frontal air bags deployed in the subject frontal impact. Further, he observed that the electrical wiring separated from the frontal impact sensor located on the vehicle's radiator support as a result of the frontal deformation. He was concerned that the separated wiring may have rendered the frontal air bag system inoperative and was the cause of the non-deployment. In-turn, he notified the National Highway Traffic Safety Administration, thus initiating this investigation.

VEHICLE DATA

2003 Ford Crown Victoria

The 2003 Ford Crown Victoria was identified by the Vehicle Identification Number (VIN): 2FAFP71W63X (production sequence deleted). The four-door, rear-wheel drive, body-on-frame, sedan was equipped with the Police Interceptor Package. A push-bumper manufactured by *Go-Rhino! Products* was mounted to the front of the vehicle. The Ford's power train consisted of a 4.6 liter/V8 engine linked to a four-speed automatic transmission. The service brakes were four-wheel disc with ABS. The manual restraint system consisted of 3-point lap and shoulder belts with retractor pretensioners for the front occupants. The vehicle was equipped with an Advanced Occupant Protection System (AOPS) that consisted of dual-stage frontal air bags. The frontal air bags were designed to tailor their deployment based on crash severity, manual restraint use and driver seat track position. The Ford was equipped with Goodyear Eagle RSA Plus P225/60R16 tires in the left front, right front and right rear positions. The left rear tire was a General XP2000 P225/60R16 tire. The recommended tire pressure for both the front and rear positions were 241 kpa (35 psi). The specific measured tire data was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	285.9 kpa (41.5 psi)	6.4 mm (8/32)	No	None
LR	196.4 kpa (28.5 psi)	5.6 mm (7/32)	No	None
RF	292.8 kpa (42.5 psi)	6.4 mm (8/32)	No	None
RR	279.0 kpa (40.5 psi)	4.8 mm (6/32)	No	None

The vehicle was owned and operated by a city police department in Ohio. At the time of the crash, the vehicle's odometer read 28,610 km (17,778 miles). The subject vehicle did not have a prior crash history and had never been out-of-service for mechanical repairs.

Figure 4 is a front view of an exemplar Ford Crown Victoria Police Interceptor and aftermarket *Go Rhino!* push bumper. This exemplar Ford CVPI was also inspected during the on-site inspection. The push bumper consisted of a steel weldment that measured 74 cm x 58 cm (29 in x 23 in), width by height. The vertical uprights of the push bumper were joined together by a 5 cm (2 in) diameter cross tube at the top and by a 15 cm x 2.5 mm (6 in x 0.100 in), width by thickness, plate at the center. The push bumper was attached directly to the bumper reinforcement bar by two U-clamps manufactured from 6.4 mm (0.25 in) plate steel. Two horizontal slots were cut into the fascia to accommodate the attachment. All the push bumpers for the city police vehicles were installed by the *Go Rhino!* distributor.

Figure 4: Exemplar Ford CVPI and push bumper.

Exterior Damage

Figures 5 and 6 are the front and left lateral views of the subject Ford. The front plane of the vehicle sustained 33.0 cm (13.0 in) of direct contact damage as a result of the tree impact. The direct damage began 36.8 cm (14.5 in) left of center on the left upright of the push bumper and ended 3.8 cm (1.5 in) left of center. The combined width of the direct and induced damage extended across the vehicle's entire 147 cm (58 in) frontal end width. The angular impact deformed the end of the left frame rail inboard. The residual location of the center of the bumper reinforcement bar was 16.8 cm (6.6 in) right of the vehicle's centerline. The direct contact damage on the hood measured 20 cm (8 in). The principle components damaged in the crash included the front bumper fascia and reinforcement bar, center grille, headlamp assemblies, hood, upper radiator support, radiator and air conditioner condenser. The right front fender shifted rearward causing a minor interference with the operation of the front right door. There was no measurable change in the wheelbase dimensions. The residual deformation measured

along the bumper reinforcement was as follows: C1 = 35.0 cm (13.8 in), C2 = 51.0 cm (20.1 in), C3 = 43.0 cm (16.9 in), C4 = 20.0 cm (7.9 in), C5 = 6.0 cm (2.4 in), C6 = 0. The Collision Deformation Classification (CDC) was 10-FYEN-2. The total Delta V calculated by the Barrier Algorithm of the WINSMASH model was 20.3 km/h (12.6 mph). The longitudinal and lateral delta V components were -13.0 km/h (-8.1 mph) and 15.5 km/h (9.6 mph), respectively. Although the results of the WINSMASH reconstruction appeared reasonable (relative to the stored RCM data), the results were considered borderline because the aftermarket push bumper was involved in the direct damage and its mounting to the bumper reinforcement bar effected the crush profile and crush parameters of the vehicle.

Figure 5: Front view of the Ford CVPI.

Figure 6: Left lateral view.

Figure 7 is a view of the residual damage to the push bumper. Direct contact to the tree was noted on the left upright and the upright deformed (twisted) inboard. The center plate of the push bumper buckled vertically and was slightly bowed. Other than the above noted damage, the push bumper was intact. The force of the impact was transmitted through the push bumper mounting points to the bumper reinforcement. The bumper structure deformed rearward and right indicative of the 10 o'clock direction of the impact.

Figure 7: Close-up of the deformed push bumper.

An electrical wiring harness spanning the width of the vehicle was located approximately 30 cm (12 in) aft of the front of the vehicle within the freespace forward of the radiator. Refer to **Figure 8**. The harness, protected by a plastic sheath and wire loom, ran forward from the engine compartment. The wiring in the harness included wiring for the headlamp assemblies, as well as a connection for the forward crash sensor of the AOPS. The crash sensor was located on the upper radiator support immediately left of the vehicle centerline. A 20 cm (8 in) long electrical lead extended from the harness and terminated in a crimped connector that attached to the sensor. During the crash sequence, the left upright of the deforming push bumper passed through the freespace forward of the radiator and deformed the electrical wiring harness. That interaction caused the harness to deform rearward and downward. The downward displacement of the harness resulted in a tensile failure of the crash sensor lead at its connector. Refer to **Figure 9**. The two wires of the lead pulled out of the crimped terminals of the connector. This disconnection resulted in the presence of an active fault code at the time of the RCM crash recording. Refer to the Advanced Occupant Protection System (AOPS) section of this report for further detail on the downloaded crash data and status of the air bag system.

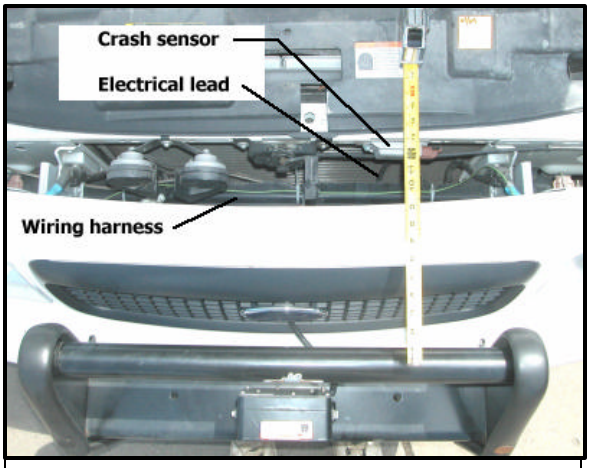


Figure 8 Overhead view of the front of an exemplar Ford CVPI and the electrical layout.

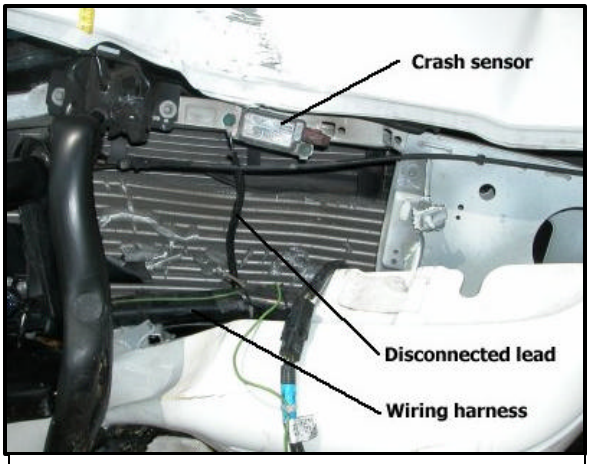


Figure 9: View of the subject CVPI and disconnected crash sensor lead.

Interior Damage

The only interior damage to the Ford consisted of the displacement of center mirror from its mount as a result of an interaction with the front right occupant. There were no noted contacts or deformations to the respective bolsters. There was no movement of the steering column shear capsules or steering wheel rim deformation.

The driver seat was located in a full rear track position. The seat back angle measured 15 degrees aft of vertical. The horizontal distance from the seat back to the steering wheel hub measured 63.5 cm (25.0 in). The driver's manual safety belt was not in use at the time of the crash. The restraint was stowed in the retractor at inspection and the retractor was operational. The retractor pretensioner had not fired. Examination of the restraint webbing identified indicators of historical use.

The front right seat was located in a full rear track position and its seat back angle measured 15 degrees. The horizontal distance from the seat back to the leading edge of the instrument panel measured 82.6 cm (32.5 in). The front right passenger was unrestrained at the time of the crash. Upon inspection, the restraint was stowed in the retractor and the retractor was operational. The retractor pretensioner had not fired. Historical use indicators were identified on the restraint upon examination.

Figure 10: Left interior view.

Figure 11: Right interior view.

Advanced Occupant Protection System (AOPS)

The 2003 Ford Crown Victoria was equipped with an Advanced Occupant Protection System (AOPS) that consisted of manual 3-point lap and shoulder belts with seat belt buckle switch sensors and retractor pretensioners for the front seats, driver seat position sensing and dual-stage air bag inflation. The driver and front right passenger air bags were designed to deploy at different thresholds of crash severity dependant on use of the manual restraints and driver seat position. The driver air bag was housed within a module located in the center hub of the steering wheel. The front right passenger air bag was a top mount design located in the right aspect of the instrument panel. The Restraint Control Module (RCM) located on the center tunnel under the instrument panel monitored and controlled the deployment of the vehicle's safety systems. The crash severity was measured by a sensor within the RCM, in conjunction with a forward satellite sensor located on the upper radiator support. The RCM was capable of recording data related to the crash event. These data were downloaded through the J1962 connector by the SCI investigator during the vehicle inspection. The downloaded data is attached to the end of this report.

During the download process, power was supplied to the vehicle's electrical system via a battery booster. The vehicle's original battery was discharged upon initial inspection. Upon cycling the ignition key to the "ON" position, the air bag lamp in the instrument cluster illuminated and the chimes sounded seven times. The indicator lamp then initiated a 42 Flash Code sequence. Inspection of the exemplar vehicle determined the 42 Flash Code was an incomplete circuit to

the forward crash sensor. By unplugging the exemplar vehicle's forward crash sensor, its air bag indicator light initiated the 42 sequence. Reconnecting the exemplar vehicle's sensor and cycling the ignition key cleared the fault code. The active flash code in the subject Ford Crown Victoria was the result of the separated electrical lead described above. Refer to Figure 9.

Analysis of the downloaded data indicated a non-deployment event was recorded. At the time the file was recorded, there was one active fault code present in the system. Presumably, that active fault code was the forward sensor open circuit (Flash Code 42). The driver indicated the air bag lamp was "OFF" prior to the crash and the vehicle did not have a prior crash history. The data further indicated the driver and front right passenger seat belts were not buckled. This data set was confirmed by the driver interview. The data indicated that no air bags or pretensioners were commanded to fire. The severity of the crash was below the threshold required for an unbelted Stage 1 or Stage 2 air bag deployment. The recorded longitudinal delta V was -10.9 km/h (-6.8 mph) at 70.4 milliseconds.

The data also indicated that had the manual restraint been buckled (in use), the pretensioner still would not have fired. The "No Fire" command was indicative of a below threshold crash severity that did not warrant any type of supplemental restraint. The analysis of the data indicated that, although the electrical lead separated at the forward crash sensor; the AOPS system operated as designed in this below threshold crash.

OCCUPANT DEMOGRAPHICS

2003 Ford Crown Victoria Police Interceptor

Age/Sex:	31 year old/Male	27 -year old/Male
Height:	185 cm (73 in)	173 cm (68 in)
Weight:	104 kg (230 lb)	107 kg (235 lb)
Seat Position:	Full rear track	Full rear track
Restraint Use:	Unrestrained	Unrestrained
Usage Source:	SCI inspection, EDR, interview	SCI inspection, EDR, interview
Medical Treatment:	Not injured	Not injured

DRIVER INJURY

2003 Ford Crown Victoria Police Interceptor

The 31year old police officer driver was not injured in the crash.

DRIVER KINEMATICS

2003 Ford Crown Victoria Police Interceptor

The 31 year old male driver was seated in a normal posture in a full rear track position. He was unrestrained at the time of the crash. The low level impact did not displace the driver forward and he was able to prevent any interior contact by bracing with his arms and legs. He exited the vehicle under his own power and was uninjured.

FRONT RIGHT PASSENGER INJURY

2003 Ford Crown Victoria Police Interceptor

The 27 year old police officer front right passenger was not injured in the crash.

FRONT RIGHT PASSENGER INJURY

2003 Ford Crown Victoria Police Interceptor

The 27 year old male front right passenger was seated in a normal posture in a full rear track position. He was unrestrained at the time of the crash. The passenger responded to the 10 o'clock direction of the impact by initiating a left and forward trajectory. He contacted and displaced the center mirror from its mount with his hands and then rebounded back into his seat. No other interior contacts were identified for this passenger during the vehicle inspection. He exited the vehicle under his own power and was uninjured.

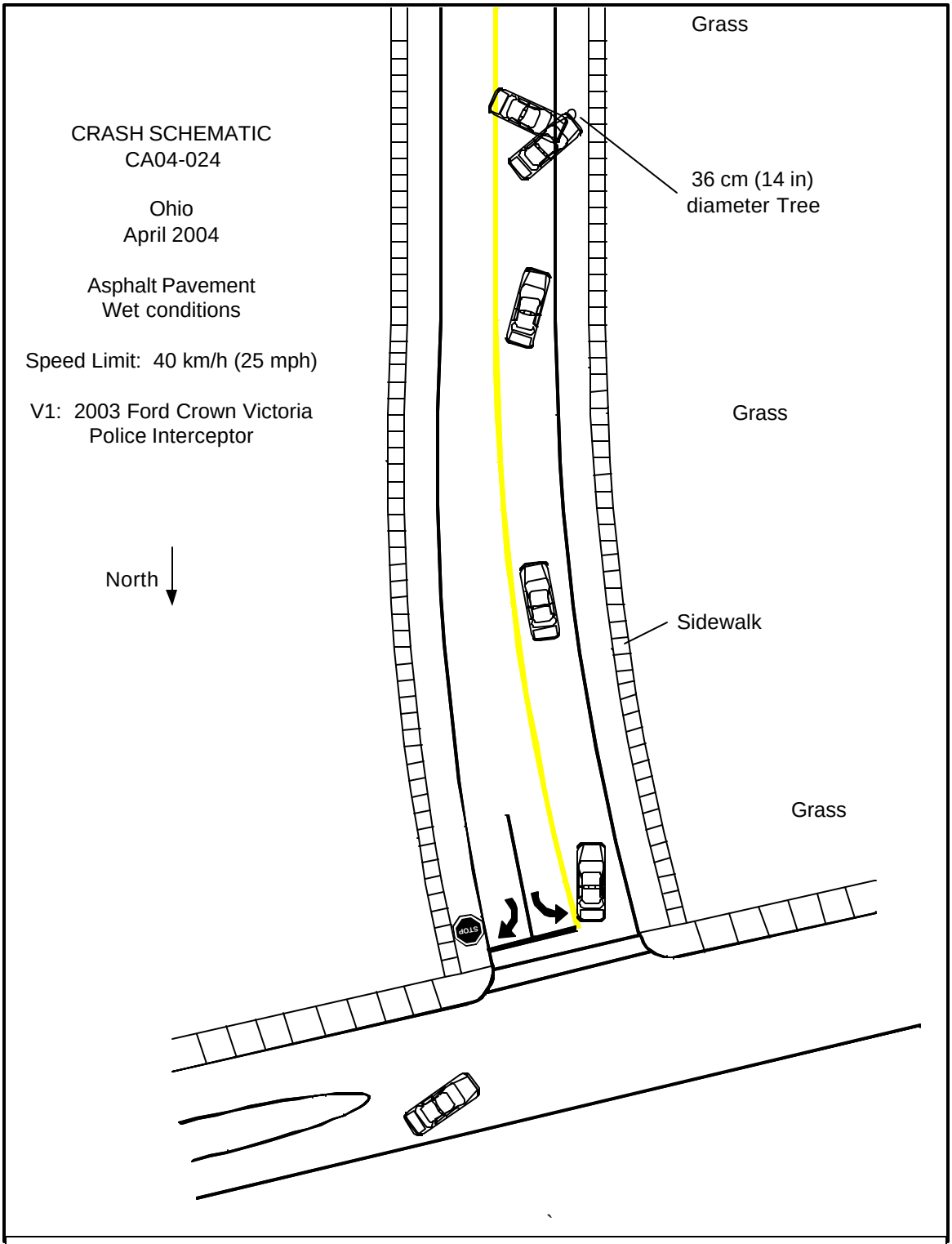


Figure 12: Crash Schematic

CDR File Information

Vehicle Identification Number	2FAFP71W63Xxxxxxx
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	
Saved on	Monday, May 10 2004 at 11:53:04 AM
Data check information	20FAD9C5
Collected with CDR version	Crash Data Retrieval Tool 2.24
Collecting program verification number	70CD83DD
Reported with CDR version	Crash Data Retrieval Tool 2.24
Reporting program verification number	70CD83DD
Interface used to collected data	Block number: 00 Interface version: 39 Date: 10-09-03 Checksum: 0300
Event(s) recovered	Non Deployment

Module Information

The retrieval of this data has been authorized by the vehicle's owner, or other legal authority such as a subpoena or search warrant, as indicated by the CDR tool user onMonday, May 10 2004 at 11:53:04 AM .

Important Limitations on Vetronix Crash Data Retrieval (CDR) Tool Capabilities.

Disclaimer: This Restraint Control Module (RCM) records longitudinal deceleration data for the purpose of understanding the input data the Restraint Control Module used to determine whether or not to deploy restraint devices. This module does not record vehicle speed, throttle position, brake on-off, and other data, which may be recorded in some 1999 model year and later General Motors modules. The deceleration data recorded by Ford's module during a crash can subsequently be mathematically integrated into a longitudinal Delta-V. Delta-V is the change in velocity during the recording time and is NOT the speed the vehicle was traveling before the accident, and is also not the Barrier Equivalent Velocity. The Vetronix CDR Tool will read and interpret both acceleration in G's and Delta-V in mph. RCM's in Ford vehicles that can be read by the Vetronix CDR tool are listed in the Vetronix Help Files.

Important

If there is any question that the restraint system did not perform as it was designed to perform, please read the system only through the diagnostic link connector. The Vetronix CDR kit provides an RCM interface cable to plug directly into the restraint control module. The Vetronix CDR RCM Interface Cable connects only power, ground, and memory read pins to the relevant vehicle restraint control module. The other RCM pins normally connect to inputs, such as sensors, and outputs, such as airbags, are not connected when you use the RCM Interface Cable to plug directly into the module. Since the vehicle restraint control module is constantly monitoring airbag system readiness, it will detect that the sensors and airbags are not connected. The restraint control module may record a new diagnostic trouble code into memory for each device that is not connected. These new diagnostic trouble codes may record over previously written diagnostic trouble codes present prior to the accident and spoil evidence necessary to determine if the restraint system performed in the accident as it was designed to perform. Not only could this prevent Ford from being able to determine if the system performed as it was designed to perform, but, regardless of innocent inadvertence, you could raise issues of evidence spoliation in any litigation that may arise out of the accident. If you cannot read the module via the diagnostic link connector, and if you suspect improper system performance, contact Ford Motor Company and request their assistance to read the module with a proper vehicle simulator attached. If you choose to read via the module connector, Ford recommends that you do so in the vehicle and that you leave the second large connector plugged into the vehicle wiring harness to minimize the number of new diagnostic trouble codes created.

While data stored in RCM's is accurate, accident reconstructionists must be aware of the limitations of the data recorded in Ford's control modules and should compare the recorded data with the physical evidence at the accident scene using professional accident reconstruction techniques (i.e. vehicle crush characteristics, skid marks, etc) before making any assumptions about the import and validity of the data recorded in the module with respect to the crash event being analyzed. The following describes specific limitations that must be considered when analyzing recorded data. Investigators should obtain permission of the vehicle owner prior to reading any data.

1. There may be no deceleration data recorded in the module.
Loss of power (cut wires, damaged battery, crushed fuse box) to the module during or immediately after the crash may prevent the crash data from being recorded. A backup power supply within the module has sufficient power to continue to analyze the deceleration data and deploy restraint devices if needed, but there is no backup power for recording.

If the deceleration input does not create a vehicle longitudinal Delta-V above 4 mph within 100 milliseconds, there may not be any data recorded.

2. In unusual circumstances, deceleration data stored in the module may be from a crash other than the one you are currently analyzing.
The module will record data from some non-deploy events. If, after the module has recorded data from a non-deploy event, and there is a subsequent event in which there is a loss of power and no new recording is made for that subsequent event, the deceleration data in the module's memory may be from the prior event. If the new, subsequent event is a deploy event and recording has occurred, the deployment times should be recorded. If there are no deployment times recorded, but airbags or other restraint devices are observed to have deployed, the recorded data that you read are most likely from a prior event.

Once an airbag or other restraint device has been commanded to deploy, the data recorded in connection with that deployment are "locked", and subsequent crashes cannot be recorded.

If a vehicle is being repaired, the RCM should be replaced after any crash in which restraint devices deploy. Early printed shop manuals refer to re-using modules by clearing the "crash data memory full" code, but this is no longer true and the latest on-line electronic shop manual directs that modules be replaced.

Crashes that involve multiple impacts will record only one of the impacts. If there is a deployment, the deployment event will be recorded and locked. If no restraint device is commanded to deploy, the recorded data are not "locked", and subsequent impacts may record over any previous recorded data. Further analysis will be required to determine which of the events was actually recorded.

3. The computed longitudinal Delta-V may understate the total Delta-V

Many real-world crashes can last longer than the memory has the capacity to record. Therefore, the actual Delta-V of the event may be higher than the Delta-V calculated and displayed by the Vetronix CDR System output. Review the end of the longitudinal acceleration/deceleration pulse - if it has not settled to zero G's by the end of the recording, the vehicle longitudinal Delta-V is most likely understated. If there is a clear decaying trend line you may choose, at your own risk, to estimate the total Delta-V by extrapolating the decay trend to zero and to calculate the additional Delta-V not captured.

Under some circumstances where power is interrupted, during the recording of data, or the module re-sets during the recording of data, a partial recording may occur. This will be shown as "no data" in the data table and will not be plotted on the graph of acceleration. The "no data" sections may be at the beginning, in the middle, or at the end(s) - it will not be consistent from one occurrence to another. When some portion of the acceleration data is not recorded, the Delta-V during that time cannot be calculated. A Delta-V will be calculated for the points that are valid, but the user must be aware that the partial Delta-V calculated will further underestimate the actual event total Delta-V. Restraint device deployment times are recorded first in to memory, and the acceleration data is recorded last. Thus, even with partial acceleration traces, deployment times are valid.

4. This module records only longitudinal acceleration/deceleration of the vehicle. You must compute lateral or resultant total acceleration based on your estimated Principal Direction of Force (PDOF).

5. Vertical acceleration/decelerations are not recorded. Vehicle spin about a point not centered on the Restraints Control Module sensor may add or subtract from bulk vehicle motion.

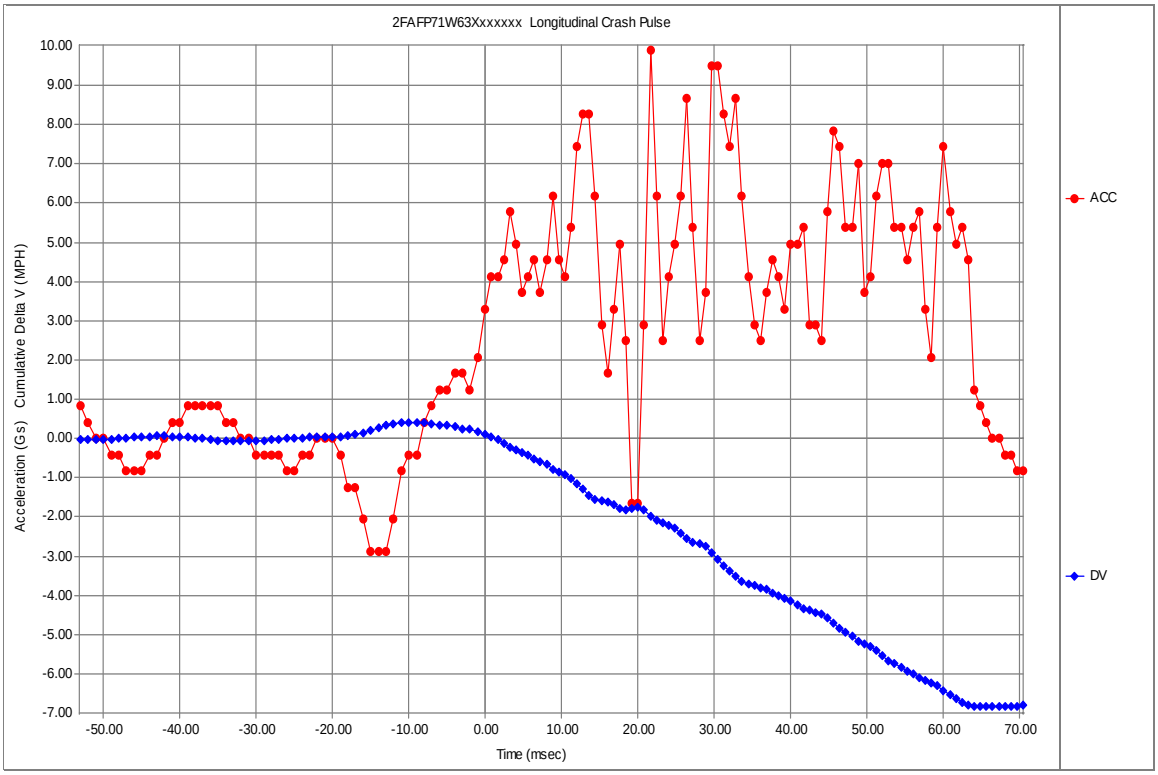
6. This module is not intended to record acceleration/deceleration in a side-impact event. If the side impact generates a longitudinal deceleration component sufficient to wake up the frontal deployment algorithm, there may be a recording of longitudinal deceleration in a side impact event.

Any Longitudinal Delta-V determined by using data read from the air bag module should be verified with physical evidence from the crash (such as vehicle crush, skid marks) and assumed accident sequence. Multiple impacts, angular collisions, side impacts, vehicle spin, etc should be considered in addition to the data read from the air bag module.

System Status At Non-Deployment

Ford Part Number Prefix	3W7A
Number Of Active Faults	1
Driver Seat Belt Buckle	Unbuckled
Passenger Seat Belt Buckle	Unbuckled
Driver Seat Track In Forward Position	No
Occupant Classification Status Value	Dual Stage
Unbelted Stage 1	No Fire
Unbelted Stage 2	No Fire
Belted Stage 1	No Fire
Belted Stage 2	No Fire
Driver Pretensioner	No Fire
Passenger Pretensioner	No Fire

Parameter	Driver	Passenger
Pretensioner Time (milliseconds)	NONE	NONE
First Stage Time (milliseconds)	NONE	NONE
Second Stage Time (milliseconds)	NONE	NONE


2FAFP71W63Xxxxxxx Longitudinal Crash Pulse
Acceleration (Gs) Cumulative Delta V (MPH)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-50.00
-40.00
-30.00
-20.00
-10.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
Time (msec)
ACC
DV

Crash Pulse Data

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
-53.0	0.83	-0.02
-52.0	0.41	-0.03
-51.0	0.00	-0.03
-50.0	0.00	-0.03
-49.0	-0.41	-0.02
-48.0	-0.41	-0.01
-47.0	-0.83	0.01
-46.0	-0.83	0.03
-45.0	-0.83	0.05
-44.0	-0.41	0.05
-43.0	-0.41	0.06
-42.0	0.00	0.06
-41.0	0.41	0.05
-40.0	0.41	0.05
-39.0	0.83	0.03
-38.0	0.83	0.01
-37.0	0.83	-0.01
-36.0	0.83	-0.03
-35.0	0.83	-0.05
-34.0	0.41	-0.05
-33.0	0.41	-0.06
-32.0	0.00	-0.06
-31.0	0.00	-0.06
-30.0	-0.41	-0.05
-29.0	-0.41	-0.05
-28.0	-0.41	-0.04
-27.0	-0.41	-0.03
-26.0	-0.83	-0.01
-25.0	-0.83	0.01
-24.0	-0.41	0.02
-23.0	-0.41	0.03
-22.0	0.00	0.03
-21.0	0.00	0.03
-20.0	0.00	0.03
-19.0	-0.41	0.04
-18.0	-1.24	0.06
-17.0	-1.24	0.09
-16.0	-2.06	0.14
-15.0	-2.89	0.20
-14.0	-2.89	0.26
-13.0	-2.89	0.33
-12.0	-2.06	0.37
-11.0	-0.83	0.39
-10.0	-0.41	0.40
-9.0	-0.41	0.41
-8.0	0.41	0.40
-7.0	0.83	0.38
-6.0	1.24	0.35
-5.0	1.24	0.33
-4.0	1.65	0.29
-3.0	1.65	0.25
-2.0	1.24	0.23
-1.0	2.06	0.18

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
0.0	3.30	0.11
0.8	4.13	0.04
1.6	4.13	-0.04
2.4	4.54	-0.12
3.2	5.78	-0.22
4.0	4.95	-0.30
4.8	3.72	-0.37
5.6	4.13	-0.44
6.4	4.54	-0.52
7.2	3.72	-0.59
8.0	4.54	-0.67
8.8	6.19	-0.78
9.6	4.54	-0.86
10.4	4.13	-0.93
11.2	5.37	-1.02
12.0	7.43	-1.15
12.8	8.26	-1.30
13.6	8.26	-1.44
14.4	6.19	-1.55
15.2	2.89	-1.60
16.0	1.65	-1.63
16.8	3.30	-1.69
17.6	4.95	-1.78
18.4	2.48	-1.82
19.2	-1.65	-1.79
20.0	-1.65	-1.76
20.8	2.89	-1.81
21.6	9.91	-1.99
22.4	6.19	-2.09
23.2	2.48	-2.14
24.0	4.13	-2.21
24.8	4.95	-2.30
25.6	6.19	-2.41
26.4	8.67	-2.56
27.2	5.37	-2.65
28.0	2.48	-2.70
28.8	3.72	-2.76
29.6	9.50	-2.93
30.4	9.50	-3.09
31.2	8.26	-3.24
32.0	7.43	-3.37
32.8	8.67	-3.52
33.6	6.19	-3.63
34.4	4.13	-3.70
35.2	2.89	-3.75
36.0	2.48	-3.80
36.8	3.72	-3.86
37.6	4.54	-3.94
38.4	4.13	-4.01
39.2	3.30	-4.07
40.0	4.95	-4.16
40.8	4.95	-4.25
41.6	5.37	-4.34
42.4	2.89	-4.39
43.2	2.89	-4.44
44.0	2.48	-4.49

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
44.8	5.78	-4.59
45.6	7.85	-4.72
46.4	7.43	-4.85
47.2	5.37	-4.95
48.0	5.37	-5.04
48.8	7.02	-5.17
49.6	3.72	-5.23
50.4	4.13	-5.30
51.2	6.19	-5.41
52.0	7.02	-5.54
52.8	7.02	-5.66
53.6	5.37	-5.75
54.4	5.37	-5.85
55.2	4.54	-5.93
56.0	5.37	-6.02
56.8	5.78	-6.12
57.6	3.30	-6.18
58.4	2.06	-6.22
59.2	5.37	-6.31
60.0	7.43	-6.44
60.8	5.78	-6.54
61.6	4.95	-6.63
62.4	5.37	-6.72
63.2	4.54	-6.80
64.0	1.24	-6.83
64.8	0.83	-6.84
65.6	0.41	-6.85
66.4	0.00	-6.85
67.2	0.00	-6.85
68.0	-0.41	-6.84
68.8	-0.41	-6.83
69.6	-0.83	-6.82
70.4	-0.83	-6.80

Hexadecimal Data

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

```
0000:  14 BB F6 03 A5 00 60 33 0E 22 0E 2B 38 55 18 1E
0010:  00 7D 0C 19 0C 19 05 CC 33 57 37 41 00 03 71 7D
0020:  07 03 CC 73 39 33 33 46 30 34 33 31 00 00 00 00
0030:  00 00 00 00 00 00 00 00 00 00 00 00 33 33 33 46
0040:  31 34 46 33 75 65 56 83 03 60 31 32 1D D2 09 00
0050:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0060:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0070:  00 00 00 00 00 00 00 04 00 00 00 00 00 00 00 00
0080:  CC 00 8D 8A 8B 8C 8A 8C 90 8C 8B 8E 93 95 95 90
0090:  88 85 89 8D 87 7D 7D 88 99 90 87 8B 8D 90 96 8E
00A0:  87 8A 98 98 95 93 96 90 8B 88 87 8A 8C 8B 89 8D
00B0:  8D 8E 88 88 87 8F 94 93 8E 8E 92 8A 8B 90 92 92
00C0:  8E 8E 8C 8E 8F 89 86 8E 93 8F 8D 8E 8C 84 83 82
00D0:  81 81 80 80 7F 7F 7F 80 80 81 82 82 83 83 83 83
00E0:  83 82 82 81 81 80 80 80 80 7F 7F 80 80 81 81 81
00F0:  80 7E 7E 7C 7A 7A 7A 7C 7F 80 80 82 83 84 84 85
0100:  85 84 86 89 8B 8B 8C 8F 00 00 00 00 00 00 00 00
0110:  00 00 00 00 00 00 00 00 00 00 00 15 00 00 00 00
0120:  00 00 00 04 00 00 00 00 00 50 00 58 4C 4B 81 20
0130:  00 33 00 01 02 6C 05 0F 05 05 02 6C 07 43 09 AE
0140:  01 02 01 01 05 07 05 05 03 05 05 0B 00 00 00 3D
0150:  00 00 01 2F 00 79 00 00 00 C2 04 D7 00 B3 01 A8
0160:  01 E4 00 C4 00 A0 01 C0 00 44 01 DF 00 F9 00 63
0170:  FF FE 03 D2 2F 44 2F 44 2F 44 02 25 01 F3 01 6D
0180:  01 DF 02 25 FF FE 00 BF FF FE 05 63 00 85 00 85
0190:  FF FE 00 6D FF FE FF FE 00 94 00 30 00 BD 00 BD
01A0:  00 00 07 02 0A 02 02 6C 04 D7 13 5C 09 AE 3D 00
01B0:  00 01 03 04 03 06 04 06 05 04 00 63 00 C2 00 79
01C0:  01 83 00 C2 00 3D 00 49 00 91 09 AE 01 F0 00 2C
01D0:  00 63 00 C6 00 63 00 F7 00 63 00 A2 00 50 01 3F
01E0:  FF FE 02 2F 01 0D 00 94 01 0D 01 E9 01 8F 00 C6
01F0:  02 A6 01 0D 01 3F 07 06 01 DF 00 C6 1F 00 2F A5
```