

Remote Combination Adaptive Driving Equipment Investigation  
Dynamic Science, Inc. (DSI), Case Number 2007-76-131G  
1990 Ford Bronco  
Arizona  
October 2007

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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.

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16. Abstract <p>This remote investigation focused on the adaptive controls (mechanical hand controls and a spinner knob) that were installed in a 1990 Ford Bronco II sport utility vehicle. The Ford was being driven by a restrained 16-year-old male. The front right seat was occupied by a restrained 14-year-old male. The second row left seat was occupied by a restrained 16-year-old male. The second row right seat was occupied by a restrained 18-year-old male. The other vehicle was a 2007 Kia Sportage sport utility vehicle that was being driven by a restrained 45-year-old male. The front right seat was occupied by a restrained 15-year-old male. The second row left seat was occupied by a restrained 17-year-old male. The second row right seat was occupied by a restrained 15-year-old male. The Bronco was traveling northbound in the second lane from the right. The Kia was traveling northbound in the right lane. The adaptive controls became caught on the driver's pant leg, causing the driver to lose control of the vehicle. The Ford initiated a sharp right turn, crossed the centerline and traveled into the right lane. The Ford traveled across the path of the Kia, and the Kia's front end contacted the right rear end of the Ford. It was not possible to determine what part of the adaptive control snagged the driver's pants.</p>		13. Type of report and period Covered [Report Month, Year]	
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**Dynamic Science, Inc.**  
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**TABLE OF CONTENTS**

Background .....	1
Summary .....	1
Crash Site .....	1
Pre-crash .....	2
Crash .....	2
Post-crash .....	2
Vehicle Data - 1990 Ford Bronco .....	2
Adaptive Hand Controls .....	3
Vehicle Damage .....	4
Exterior Damage .....	4
Interior Damage .....	4
Manual Restraints .....	4
Occupant Demographics .....	4
Occupant Injuries .....	5
Occupant Kinematics .....	5
Scene Diagram .....	6

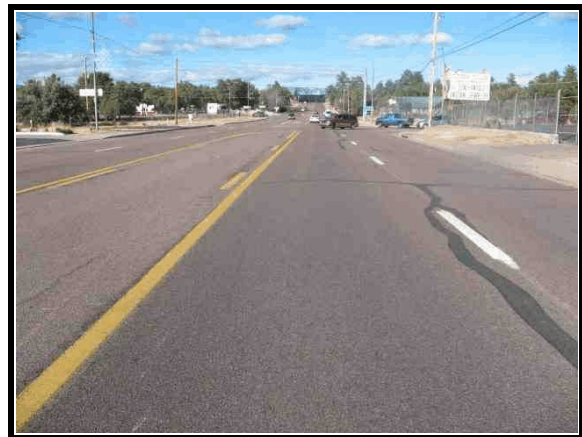
## BACKGROUND

This remote investigation focused on the adaptive controls (mechanical hand controls and a spinner knob) that were installed in a 1990 Ford Bronco II sport utility vehicle (**Figure 1**). The Ford was being driven by a restrained 16-year-old male. The front right seat was occupied by a restrained 14-year-old male. The second row left seat was occupied by a restrained 16-year-old male. The second row right seat was occupied by a restrained 18-year-old male. The other vehicle was a 2007 Kia Sportage sport utility vehicle that was being driven by a restrained 45-year-old male. The front right seat was occupied by a restrained 15-year-old male. The second row left seat was occupied by a restrained 17-year-old male. The second row right seat was occupied by a restrained 15-year-old male. The Ford was traveling northbound in the second lane from the right. The Kia was traveling northbound in the right lane. The adaptive controls became caught on the Bronco driver's pant leg, causing the driver to lose control of the vehicle. The Ford then initiated a sharp right turn, crossed the centerline and traveled into the right lane. The Ford traveled across the path of the Kia, and the Kia's front end contacted the right side rear of the Ford. It was not possible to determine what part of the adaptive control snagged the driver's pants. It was not possible to determine what part of the adaptive control snagged the driver's pants.



**Figure 1.** Subject vehicle, 1990 Ford Bronco II

This Remote Combination Adaptive Driving Equipment Investigation was initiated in response to a notification from an Arizona National Automotive Sampling System (NASS) Primary Sampling Unit (PSU) who reported an incident where adaptive driving controls were installed in a 1990 Ford Bronco II that was involved in a two-vehicle crash. DSI was assigned the case on January 14, 2008. The following information was obtained from the electronic case and the police report. The driver could not be located.



**Figure 2.** Approach to area of impact (north)

## SUMMARY

### Crash Site

This two-vehicle crash occurred on a five-lane, undivided roadway in October 2007 at 2040 hours. At the crash location, there were two northbound lanes separated by a single broken white line (**Figure 2**). This section of the roadway was straight and level. The crash occurred at night, and there were streetlights present. The weather was clear and the asphalt roadway was dry. The posted

speed limit was 64 km/h (45 mph).

### **Pre-Crash**

The Ford Bronco was traveling northbound in the second lane from the right. The Kia was traveling northbound in the outboard lane. The Ford was equipped with adaptive hand controls. The adaptive controls became caught on the driver's pant leg, causing the driver to lose control of the vehicle. The Ford then initiated a sharp right turn, crossed the centerline and traveled into the outboard lane.

### **Crash**

The front left corner of the Kia contacted the right rear quarter panel of the Ford resulting in minor damage. The NASS PSU did not obtain any specific crush measurements from the vehicle; therefore, no delta-V could be calculated.

### **Post-Crash**

There were no injuries reported. The Ford Bronco was driven from the scene. According to the police report, the Kia was towed from the scene due to damage. The NASS PSU did not inspect the Kia.

### **VEHICLE DATA - 1990 Ford Bronco**

The 1990 Ford Bronco II was identified by the Vehicle Identification Number (VIN): 1FMCU14T7LUxxxxxx. There was no odometer data found in the electronic file. The Bronco was a compact four-door sport utility vehicle that was equipped with a 2.9 liter, 6-cylinder engine, 4-wheel drive, an automatic transmission, and a tilt steering wheel. The Bronco was configured with Dayton Timberline P235/75R15 tires. The tire manufacturer's recommended maximum pressure was 345 kPa (50 psi). The vehicle manufacturer recommended P205/65R15SL tires, and the recommended cold tire pressure was 241 kPa (35 psi).

The specific tire information was as follows:

<b>Position</b>	<b>Measured Pressure</b>	<b>Measured Tread Depth</b>	<b>Restricted</b>	<b>Damage</b>
LF	214 kPa (31 psi)	10 mm (13/32 in)	None	None
RF	214 kPa (31 psi)	10 mm (13/32 in)	None	None
LR	214 kPa (31psi)	10 mm (13/32 in)	None	None
RR	241 kPa (35 psi)	9 mm (11/32 in)	None	None

## Adaptive Hand Controls

The driver of the Ford carried an Arizona driver's license with a code "F" restriction. The code "F" restriction means that the driver was restricted to driving vehicles equipped with full hand controls.

The Ford Bronco was equipped with push/pull lever operated foot controls and a steering wheel spinner knob (Figures 3-5). The push/pull brake and accelerator lever was mounted on the left side of the steering column and was intended to be operated with the left hand. The control was designed to accelerate when moved forward and to brake when moved rearward. The adaptation was designed for use in a vehicle with an automatic transmission and for a person who is unable to use, or has difficulty using, their legs to operate the pedals for accelerating and braking.

Efforts were taken to contact the driver to determine his level of experience and training in the use of adaptive controls, as well as information regarding the installation of the controls, but the driver could not be located.



**Figure 3.** Push/pull lever



**Figure 4.** Side view of hand control installation



**Figure 5.** Steering wheel spinner knob

## Vehicle Damage

### Exterior Damage - 1990 Ford Bronco II

The Ford sustained minor damage as a result of the impact with the Kia Sportage (**Figure 6**). The Collision Deformation Classification (CDC) for this impact was 03RBEW1. No crush measurements were taken by the NASS PSU.

### Interior Damage - 1990 Ford Bronco II

There was no interior damage. There were no intrusions and no integrity loss.

### Manual Restraints - 1990 Ford Bronco II

The Ford Bronco was equipped with 3-point manual lap and shoulder belts for all four outboard seating positions, and a manual lap belt for the second row center seat. According to the police report, all four occupants were using their respective restraints.



**Figure 6.** Right side damage to Ford Bronco

## OCCUPANT DEMOGRAPHICS - 1990 Ford Bronco

	Driver	Front right passenger
Age/Sex:	16/Male	14/Male
Seated Position:	Front row left	Front row right
Seat Type:	Bucket	Bucket
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Driving Experience:	Unknown	N/A
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used per police report	Lap and shoulder belt used per police report



	Second row left passenger	Second row right passenger
Age/Sex:	16/Male	18/Male
Seated Position:	Second row left	Second row right
Seat Type:	Bench with folding back	Bench with folding back
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used per police report	Lap and shoulder belt used per police report

## OCCUPANT INJURIES

There were no occupant injuries.

## OCCUPANT KINEMATICS

### Driver Kinematics

The 16-year-old driver was seated in an unknown posture. His right hand was on the steering wheel and his left was operating the left side mounted hand control. The Ford was traveling on a straightaway. At some point, the adaptive control snagged on the driver's pant leg. This caused the Ford to veer to the right and contact the Kia Sportage in the right lane. This was a minor impact resulting in no injuries.

### Front Right Passenger Kinematics

The 14-year-old male front right passenger was seated in an unknown. The Bronco was traveling on a straightaway when the vehicle veered to the right and contacted a Kia Sportage in the right lane. This occupant was not injured.

### Second Row Left Passenger Kinematics

The 16-year-old male second row left passenger was seated in an unknown posture. The Bronco was traveling on a straightaway. The Bronco was traveling on a straightaway when the vehicle veered to the right and contacted a Kia Sportage in the right lane. This occupant was not injured.

### Second Row Right Passenger Kinematics

The 18-year-old male second row right passenger was seated in an unknown posture. The Bronco was traveling on a straightaway. The Bronco was traveling on a straightaway when the vehicle veered to the right and contacted a Kia Sportage in the right lane. This occupant was not injured.

Scene Diagram

