

REPORT NUMBER: TWG-TRC-13-04

**NEW CAR ASSESSMENT PROGRAM (NCAP)**  
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING

CHRYSLER GROUP LLC  
2013 JEEP COMPASS  
SPORT 4X4 4-DOOR

NHTSA NUMBER: MD0307TWG2  
TRC TEST NUMBER: S130408

PREPARED BY:  
TRANSPORTATION RESEARCH CENTER INC.  
10820 State Route 347  
P.O. BOX B-67  
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Test Date: April 8, 2013

FINAL REPORT

Alpha Technology Associate, Inc.  
2810 Old Lee Highway, Suite 120  
Fairfax, VA 22031

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-08-D-00088, Alpha Technology PO 4GT150. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

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Approved By:   
Margaret Susan, Project Manager

Approval Date: \_\_\_\_\_

FINAL REPORT ACCEPTANCE BY:

Accepted By: \_\_\_\_\_

Acceptance Date: \_\_\_\_\_

## TECHNICAL REPORT STANDARD TITLE PAGE

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4. Title and Subtitle Final Report 2013 Jeep Compass Sport 4X4, TWG/Out-of-Position Tests NHTSA No.: MD0307TWG2		5. Report Date April 23, 2013		6. Performing Organization Code TRC		
		8. Performing Organization Report No. S130408				
7. Author(s)  Margaret Susan, Project Manager		10. Work Unit No.				
9. Performing Organization Name and Address Transportation Research Center Inc. 10820 State Route 347 East Liberty, OH 43319		11. Contract or Grant No. DTNH22-08-D-00088				
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12. Sponsoring Agency Name and Address Alpha Technology Associate, Inc 2810 Old Lee Hwy, Suite 120 Fairfax, VA 22031		14. Sponsoring Agency Code NVS-111				
		15. Supplementary Notes				
16. Abstract This side impact Out-Of-Position test was performed in conjunction with a New Car Assessment Program (NCAP). This test was conducted at the T R C Test Facility in East Liberty, O h i o , on April 8, 2013.						
<b>Injury Summary</b>						
<b>HIC15</b>	<b>Maximum Chest Displacement (mm)</b>	<b>Maximum Chest Displacement Rate (m/s)</b>	<b>NIJ(NTF)</b>	<b>NIJ(NTE)</b>	<b>NIJ(NCF)</b>	<b>NIJ(NCE)</b>
19.720	N/A	N/A	0.0415	0.2064	0.1584	0.2995
17. Key Words New Car Assessment Program (NCAP) Side Airbag Out-Of-Position			18. Distribution Statement <u>Copies of this report are available from:</u> Alpha Technology Associate, Inc 2810 Old Lee Hwy, Suite 120 Fairfax, VA 22031 Phone: (703) 876-0010 Fax: (703) 876-0120 Attn: Mai Lan Aram			
19. Security Classification of Report  UNCLASSIFIED	20. Security Classification of Page  UNCLASSIFIED		21. No. of Pages  29	22. Price		

## TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	PURPOSE AND SUMMARY OF TEST	1
2	DATA SHEETS	2
	Data Sheet 1 – Test Summary	2
	Data Sheet 2 – Vehicle Parameter Data	3
	Data Sheet 3 – Dummy Positioning in Vehicle	4
	Data Sheet 4 – Dummy Injury Criteria Values	5
A	PHOTOGRAPHS	A-1
B	DUMMY RESPONSE DATA TRACES	B-1
C	TEST EQUIPMENT LIST AND CALIBRATION INFORMATION	C-1

## SECTION 1

### TEST PURPOSE AND PROCEDURE

#### 1.1 PURPOSE

The purpose of this test was to obtain data from a static out-of-position side impact using a vehicle that had undergone a New Car Assessment Program (NCAP) sponsored test requested by the National Highway Traffic Safety Administration (NHTSA). This test was performed following the technical requirements under NHTSA contract No. DTNH22-08-D-00088 and through Alpha Technology Associate, Inc.

#### 1.2 SUMMARY

The effects of both a seat-mounted side airbag and a curtain airbag deployment in a 2013 Jeep Compass Sport 4X4 4 door on an out-of-position Hybrid III 6-year-old anthropomorphic test device (ATD) were evaluated. The test was performed by TRC on April 8, 2013. Pre- and post-test photographs of the vehicle and ATD can be found in Appendix A.

Two (2) high-speed digital cameras were used to document the side airbag deployment event. Images were recorded at rates of 1000 frames per second. One camera was placed perpendicular to the right-front seat centerline to capture the deployment event from the side. The second camera was placed parallel to the right- front seat centerline to capture the deployment event from the front.

The Hybrid III 6-year-old anthropomorphic test device (ATD) was placed in the right front (passenger) seat on a booster block situated perpendicular to the centerline of the seat, facing inboard. This was placed following the ATD placement instructions specified in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as prepared by the Side Airbag Out-of-Position Injury Technical Working Group (TWG). The specific test was section 3.3.5.1.

The Hybrid III 6-year-old ATD was instrumented with head x, y and z accelerometers, six upper neck axial force and moment load cell transducers, and six lower neck axial force and moment load cell transducers.

Nineteen (19) channels of data were recorded using an on-board data acquisition system. Appendix A contains photographs. Appendix B contains ATD response data traces. Appendix C contains the Instrumentation Data Channel assignments.

The Hybrid III 6-year-old ATD was positioned in the seat on a foam block facing inboard with its arms hanging at its sides and its legs extended. The seat track was positioned forward to minimize the vertical distance between the dummy's head and the roof-rail module and to maximize the cushion to head interaction. The head was kept in its neutral orientation while the dummy's pelvis was slid outboard until the dummy's back contacted the door and the center of gravity of the head was centered in the deployment trajectory of the airbag. A vertical plane through the centerline of the dummy's shoulder bolts was parallel to the vehicle centerline. The dummy's arms were bent at the elbow until the fingers just touched the foam block. This orientation complies with section 3.3.5.1 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags, First Revision dated July, 2003.

**SECTION 2**

**DATA SHEET NO. 1  
 TEST SUMMARY**

**TEST CONFIGURATION INFORMATION:**

<b>Seating Position:</b>	P2	Right Front Seating Position
<b>Test:</b>	3.3.5.1	Inboard Facing Hybrid III 6-year-old on booster block (Passenger Positions with Roof-Rail-Mounted Airbags)
<b>Airbag:</b>	Seat	Seat mounted – outside seam
<b>Airbag:</b>	Side Rail	Side curtain airbag.
<b>Booster Block:</b>	N/A	N/A
<b>ATD Type/Serial No.:</b>	182	Hybrid III 6-year-old

**SEAT POSITION**

Measurement	Value
Total Fore/Aft Travel (Detents)	39
Placed in Position #	22

<b>Number of Data Channels:</b>	19	
<b>Number of Cameras:</b>	0	<u>Real Time</u>
	2	<u>High Speed Digital</u>

**VISIBLE DUMMY CONTACT POINTS**

<b>Head Contact:</b>	Curtain Airbag, I/P
<b>Upper Torso Contact:</b>	Torso Airbag
<b>Lower Torso Contact:</b>	None
<b>Left Knee Contact:</b>	None
<b>Right Knee Contact:</b>	None

**DATA SHEET NO. 2**

**GENERAL TEST AND VEHICLE PARAMETER DATA**

**TEST VEHICLE INFORMATION**

NHTSA No.	MD0307
Model Year	2013
Make	Jeep
Model	Compass Sport
Body Style	MPV
VIN	1C4NJDBB0DD158488
Body Color	Silver
Odometer Reading (km/mi)	13
Engine Displacement (L)	2.4
Type/No. Cylinders	4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	CVT
Overdrive	No
Final Drive	All Wheel
Roof Rack	Yes
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

**TEST VEHICLE OPTIONS**

Traction Control System (TCS)	Yes
Power Steering	Yes
Power Window Auto-Reverse	Yes
Driver Frontal Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Front Pass. Frontal Airbag	Yes
Front Pass. Curtain Airbag	Yes
Front Pass. Head/Torso Airbag	No
Front Pass. Torso Airbag	No
Front Pass. Torso/Pelvis Airbag	Yes
Front Pass. Pelvis Airbag	No
Front Pass. Knee Airbag	No
Driver Pretensioner	Yes
Driver Load Limiter	No
Front Pass. Pretensioner	Yes
Front Pass. Load Limiter	No
Other	NA

Does owner's manual provide instructions to turn off automatic door locks? Yes

**DATA FROM CERTIFICATION LABEL**

Manufactured by	Chrysler Group LLC	GVWR (kg)	2076
Date of Manufacture	8/12	GAWR Front (kg)	1000
		GAWR Rear (kg)	1044

**VEHICLE SEATING AND WEIGHT CAPACITY**

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				
Cargo Wt. (RCLW) (kg)				

**DATA SHEET NO. 3**

**DUMMY POSITIONING IN VEHICLE**

Measurement		Value
Seat Fore/Aft Position		22 <sup>nd</sup> Detent
Seat Vertical Position		NA
Placed in Position # 2		Right Front
Seat Back Angle at Headrest Post	SA (°)	16.1
Top of Curtain Airbag Module to Head/Neck Junction	AN (mm)	270
Top of Seat Airbag Module to Head/Neck Junction	AN (mm)	315
Head CG to Door Panel/Window	HD (mm)	265
Head to Seat Back Centerline	HSC (mm)	290
Chest to Seat	CD (mm)	400
Chest to Seat Back	CS (mm)	250
Right Arm to Seat Back Centerline	RACL (mm)	220
Left Arm to Seat Back Centerline	LACL (mm)	215
Right Arm to Door Panel	RA (mm)	65
Left Arm to B-Post	LA (mm)	90
Knee to Knee	KK (mm)	110
Toe to Toe	TT (mm)	90
Right Knee to Seat Cushion Centerline	KSCR (mm)	60
Left Knee to Seat Cushion Centerline	KSCL (mm)	60
Right Toe to Seat Cushion Centerline	TSCR (mm)	365
Left Toe to Seat Cushion Centerline	TSCL (mm)	365
Nose to Seat	ND (mm)	570
Nose to Seat Back	NS (mm)	345
Top of Head to Headliner	HH (mm)	123

**DATA SHEET NO. 4  
 DUMMY INJURY CRITERIA VALUES**

Channel	Max	Time (ms)	Min	Time (ms)
Head Ax [g , CFC_1000]	57.12	12.80	-14.33	303.44
Head Ay [g , CFC_1000]	36.21	13.20	-24.56	302.56
Head Az [g , CFC_1000]	31.12	12.80	-5.47	16.80
Upper Neck Fx [N , CFC_1000]	53.03	310.00	-184.73	12.80
Upper Neck Fy [N , CFC_1000]	168.58	13.28	-56.23	107.44
Upper Neck Fz [N , CFC_1000]	120.52	25.36	-470.39	15.44
Upper Neck Mx [N-m , CFC_600]	15.99	25.28	-9.99	11.60
Upper Neck My [N-m , CFC_600]	4.12	63.04	-8.72	22.00
Upper Neck Mz [N-m , CFC_600]	3.76	115.36	-8.72	57.92
Lower Neck Fx [N , CFC_1000]	116.46	13.20	-207.04	22.72
Lower Neck Fy [N , CFC_1000]	310.30	22.80	-78.20	305.04
Lower Neck Fz [N , CFC_1000]	123.87	25.28	-430.77	17.28
Lower Neck Mx [N-m , CFC_600]	33.49	31.52	-14.50	110.40
Lower Neck My [N-m , CFC_600]	20.11	45.60	-5.85	25.36
Lower Neck Mz [N-m , CFC_600]	11.29	13.12	-9.82	50.16
Airbag Event Passenger Side Curtain Voltage [V]	25.51	0.72		
Airbag Event Front Passenger Seat Voltage [V]	26.99	0.64		
Airbag Event Passenger Side Curtain Current [A]	3.42	0.48		
Airbag Event Front Passenger Seat Current [A]	3.30	0.48		

**HEAD INJURY CRITERIA (HIC)**

	HIC(15)	t <sub>1</sub> (msec)	t <sub>2</sub> (msec)	HIC(36)	t <sub>1</sub> (msec)	t <sub>2</sub> (msec)
Position #2 Right Front	19.72	299.840	310.000	19.72	299.840	310.000

**Position 2 Neck Injury Summary (SID-IIs )**

Nij V10	Nij	Time (ms)
Upper Neck NTF	0.0415	84.08
Upper Neck NTE	0.2064	25.28
Upper Neck NCF	0.1584	15.44
Upper Neck NCE	0.2995	20.88

**Peak Tension (CFC1000) 121 N      Peak Compression (CFC1000) -470 N**

**Critical Values**

Nij Intercepts				Peak Limits	
Tension (CVt)	2880	Extension (mCVe)	37 N-m	Tension	1490 N
Compression (CVc)	2880	Flexion (mCVf)	93 N-m	Compression	1820 N

Test Vehicle: 2013 Jeep Compass Sport  
Test Program: Side Airbag O.O.P. Injury Testing

NHTSA No.: MD0307TWG2  
Test Date: 4/8/13

**APPENDIX A**  
**PHOTOGRAPHS**

### TABLE OF PHOTOGRAPHS

<u>Figure</u>	<u>Photograph Title</u>	<u>Page</u>
Figure A-1	Right ¾ Front View of Vehicle, As Received	A-3
Figure A-2	Vehicle Certification Placard	A-3
Figure A-3	Pre-Crash Test Images from NCAP Vehicle	A-4
Figure A-4	Post-Crash Test images From NCAP Vehicle	A-4
Figure A-5	Pre-Test Front Right Dummy position – Right Side View	A-5
Figure A-6	Pre-Test Front Right Dummy position ¾ View	A-5
Figure A-7	Pre-Test Front Right Dummy position – Front View	A-6
Figure A-8	Pre-Test Front Right Dummy position – Left Side View	A-6
Figure A-9	Post-Test Front Right Dummy position – Left Side View	A-7
Figure A-10	Post-Test Front Right Dummy position ¾ View	A-7
Figure A-11	Post-Test Front Right Dummy position – Front View	A-8
Figure A-12	Post-Test Front Passenger Airbags – Left Side View	A-8
Figure A-13	Pre-Test Overall Testing Area (Photo Not Available)	A-9
Figure A-14	Post-Test Overall Testing Area (Photo Not Available)	A-9
Figure A-15	Post-Test Front Passenger Door-Window	A-10



Figure A-1 Right ¾ Front View, as Received

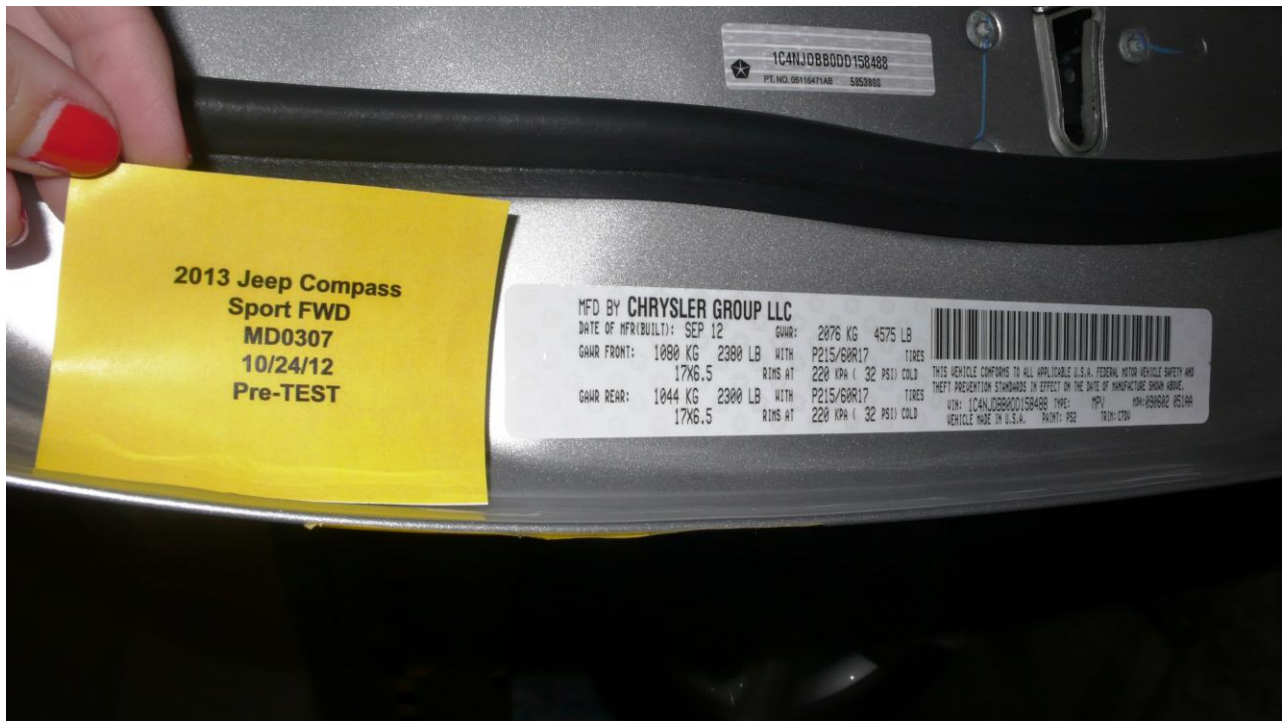


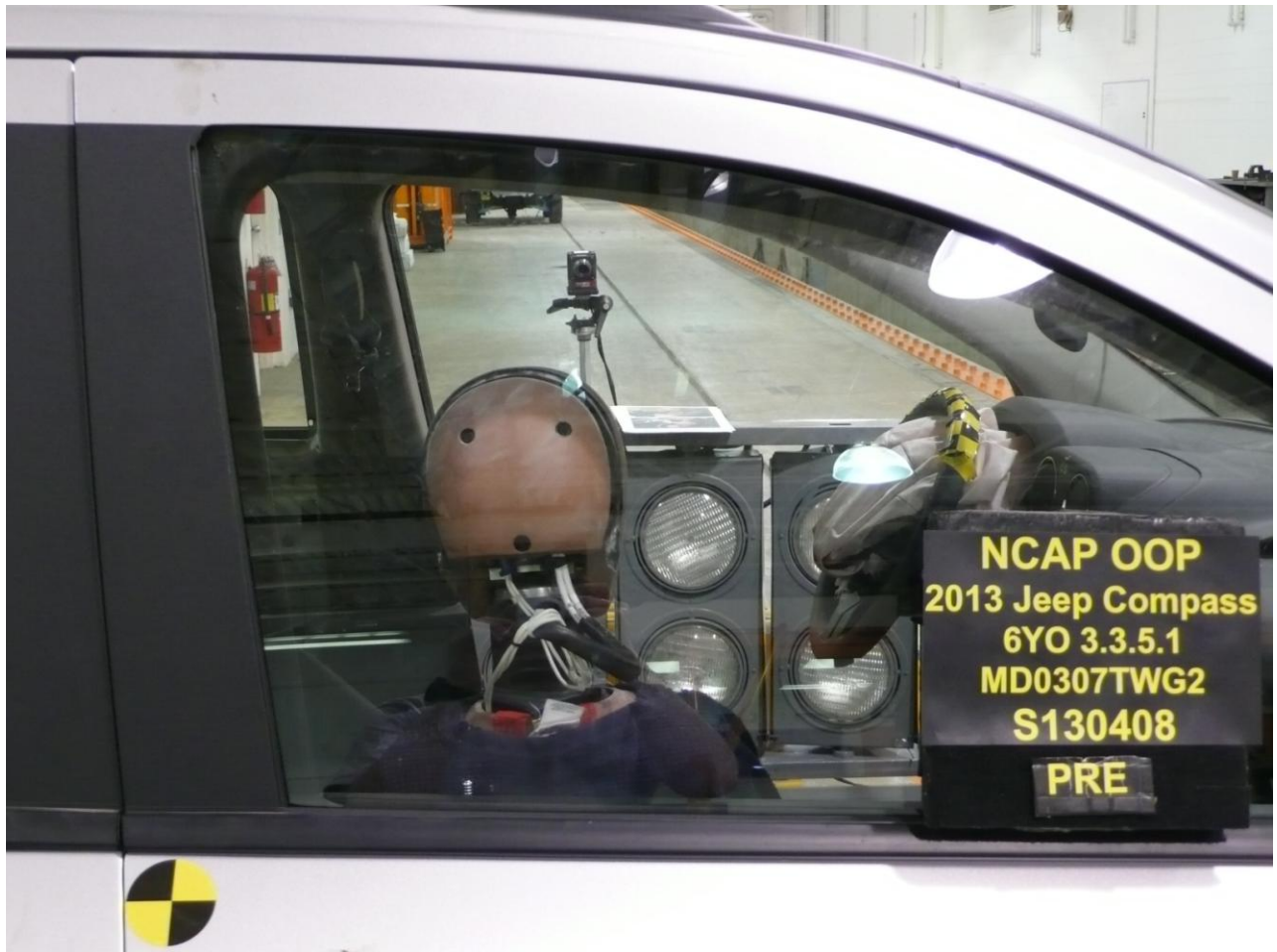
Figure A-2 Vehicle Certification Label



**Figure A-3 Pre-Crash Test Images From NCAP Vehicle**



**Figure A-4 Post-Crash Test Images From NCAP Vehicle**



**Figure A-5 Pre-Test Right Front Dummy Position – Right Side View**



**Figure A-6 Pre-Test Right Front Dummy Position – 3/4 View**



Figure A-7 Pre-Test Right Front Dummy Position – Front View



Figure A-8 Pre-Test Right Front Dummy Position – Left Side View



**Figure A-9 Post-Test Right Front Dummy Position – Left Side View**



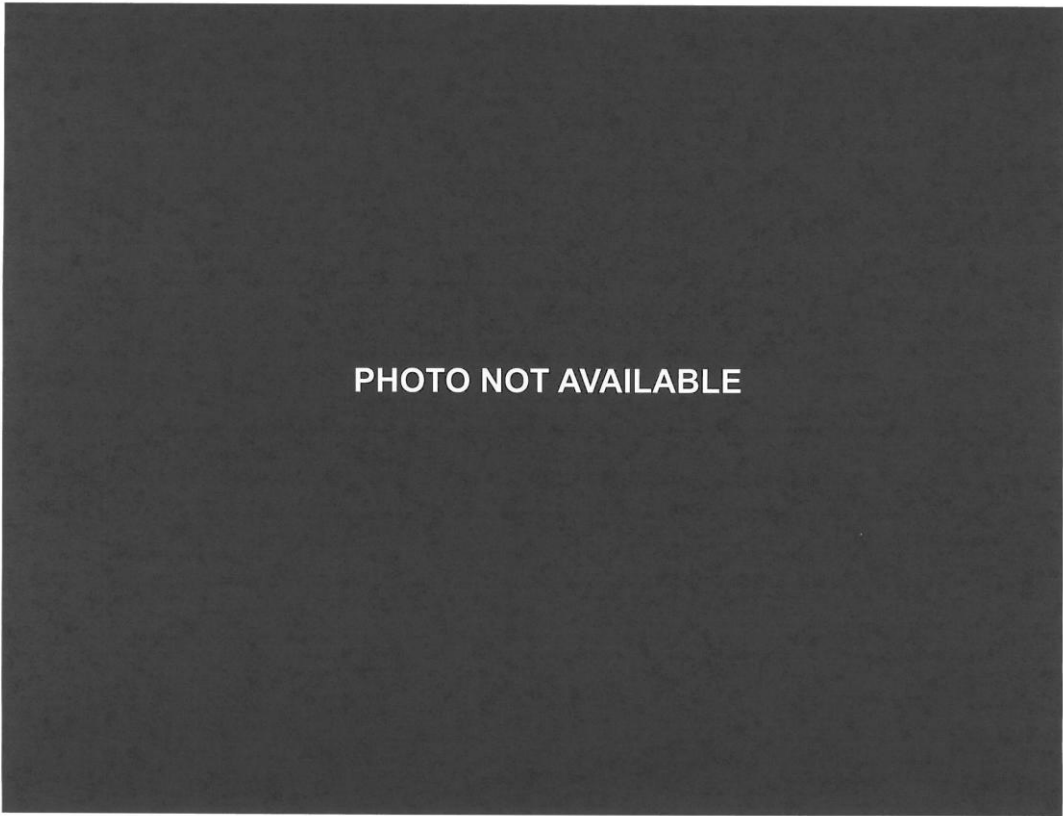
**Figure A-10 Post-Test Right Front Dummy Position – 3/4 View**



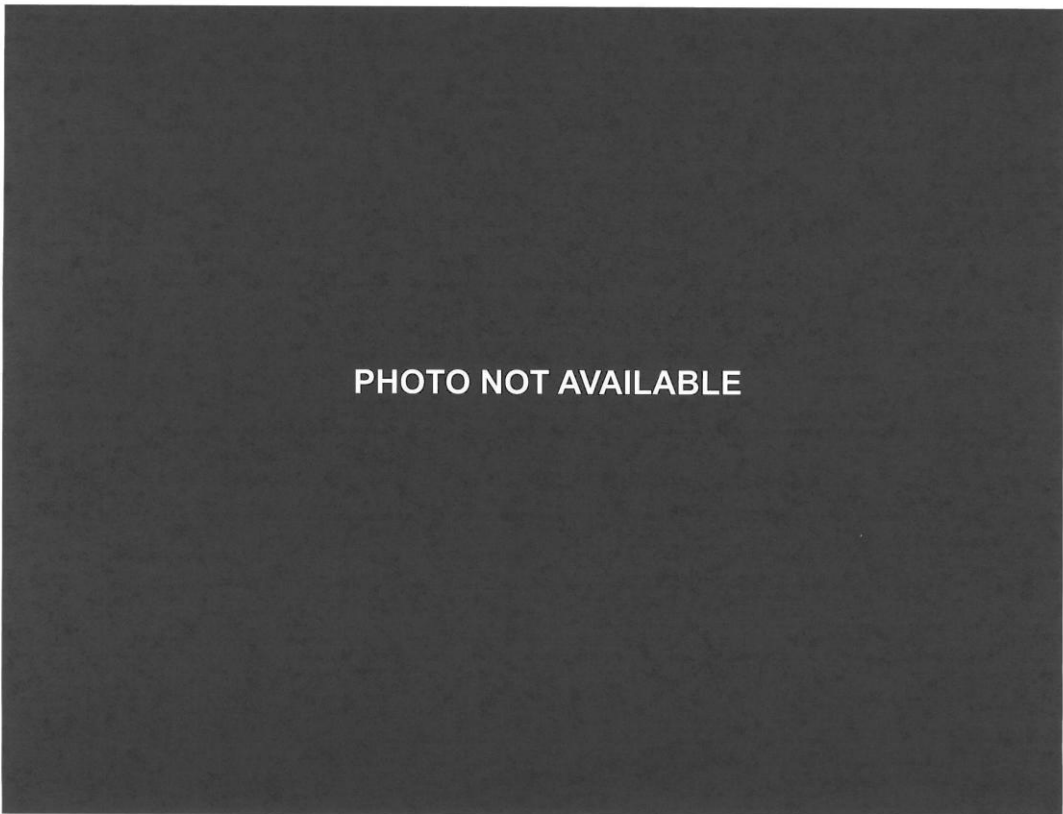
**Figure A-11 Post-Test Right Front Dummy Position – Front View**



**Figure A-12 Post-Test Front Passenger Airbags – Left Side View**



**Figure A-13 Pre-Test Overall Testing Area**



**Figure A-14 Post-Test Overall Testing Area**



**Figure A-15 Post-Test Front Passenger Door-Window**

Test Vehicle: 2013 Jeep Compass Sport  
Test Program: Side Airbag O.O.P. Injury Testing

NHTSA No.: MD0307TWG2  
Test Date: 4/8/13

## **APPENDIX B**

### **Hybrid III 6-year-old RESPONSE DATA TRACES**

**Table of Data Plots**

<b>No.</b>	<b>List of Data Plots Provided in the Test Report</b>	<b>Page</b>
<b>1</b>	Passenger Head Acceleration (X) Primary vs. Time	<b>B-3</b>
<b>2</b>	Passenger Head Acceleration (Y) Primary vs. Time	<b>B-3</b>
<b>3</b>	Passenger Head Acceleration (Z) Primary vs. Time	<b>B-3</b>
<b>4</b>	Passenger Head Resultant Acceleration Primary vs. Time	<b>B-3</b>
<b>5</b>	Passenger Upper Neck Force X vs. Time	<b>B-4</b>
<b>6</b>	Passenger Upper Neck Force Y vs. Time	<b>B-4</b>
<b>7</b>	Passenger Upper Neck Force Z vs. Time	<b>B-4</b>
<b>8</b>	Passenger Upper Neck Moment X vs. Time	<b>B-5</b>
<b>9</b>	Passenger Upper Neck Moment Y vs. Time	<b>B-5</b>
<b>10</b>	Passenger Upper Neck Moment Z vs. Time	<b>B-5</b>
<b>11</b>	Passenger Lower Neck Force X vs. Time	<b>B-6</b>
<b>12</b>	Passenger Lower Neck Force Y vs. Time	<b>B-6</b>
<b>13</b>	Passenger Lower Neck Force Z vs. Time	<b>B-6</b>
<b>14</b>	Passenger Lower Neck Moment X vs. Time	<b>B-7</b>
<b>15</b>	Passenger Lower Neck Moment Y vs. Time	<b>B-7</b>
<b>16</b>	Passenger Lower Neck Moment Z vs. Time	<b>B-7</b>
<b>17</b>	Airbag Event Front Passenger Seat vs. Time	<b>B-8</b>
<b>18</b>	Airbag Event Passenger Side Curtain vs. Time	<b>B-8</b>
<b>19</b>	Airbag Event Front Passenger Seat vs. Time	<b>B-8</b>
<b>20</b>	Airbag Event Passenger Side Curtain vs. Time	<b>B-8</b>

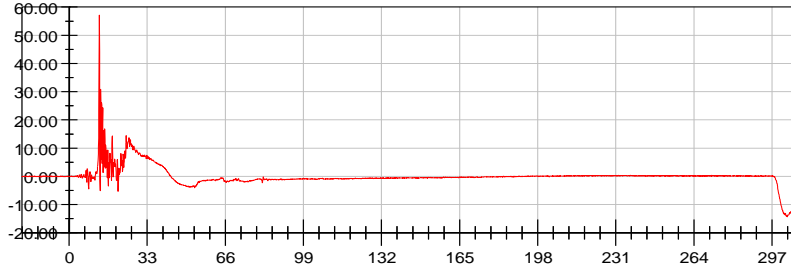
# Alpha Technology

Test Lab: SLED

Test Number: S130408 (MD0307TWG2)

Test Date: 04/08/2013  
Position #2 Hybrid III 6 year old Dummy (Part 572 N) (182)

Head Accel X (g) vs. Time [ms]



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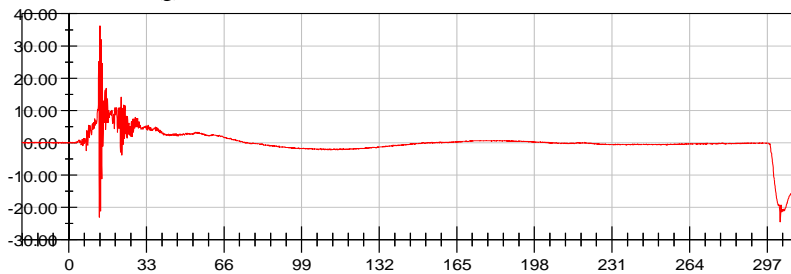
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-14.33 g at 303.44 ms

CFC\_1000

Head Accel Y (g) vs. Time [ms]



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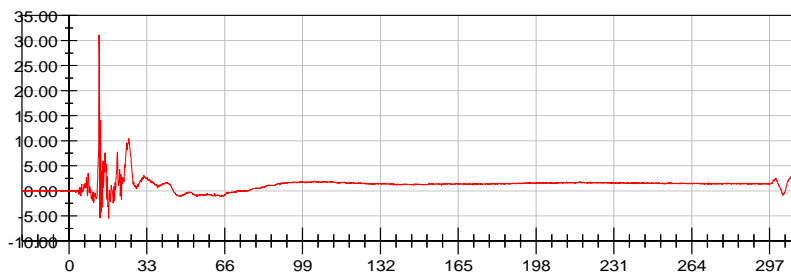
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-24.56 g at 302.56 ms

CFC\_1000

Head Accel Z (g) vs. Time [ms]



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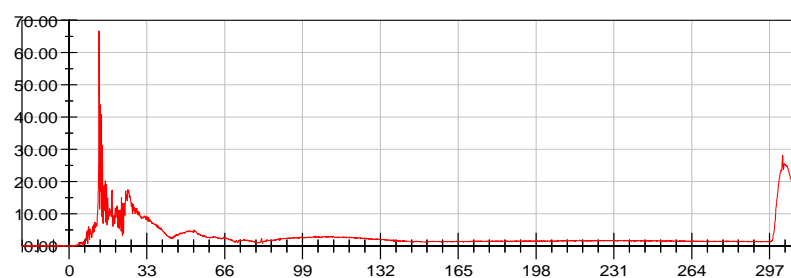
31.12 g at 12.80 ms

<Min>

-5.47 g at 16.80 ms

CFC\_1000

Head Accel Resultant (g) vs. Time [ms]



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66.72 g at 12.72 ms

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0.04 g at -17.84 ms

CFC\_1000

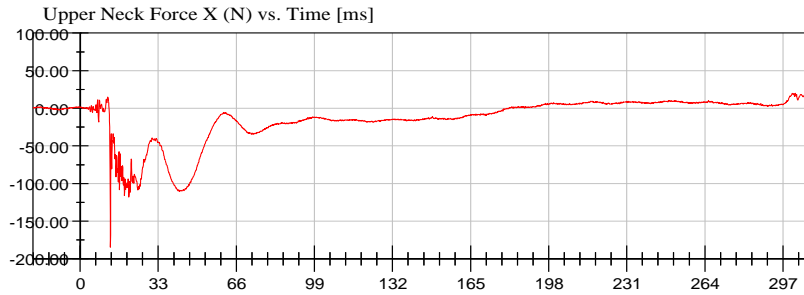


# Alpha Technology

Test Lab: SLED

Test Number: S130408 (MD0307TWG2)

Test Date: 04/08/2013  
Position #2 Hybrid III 6 year old Dummy (Part 572 N) (182)



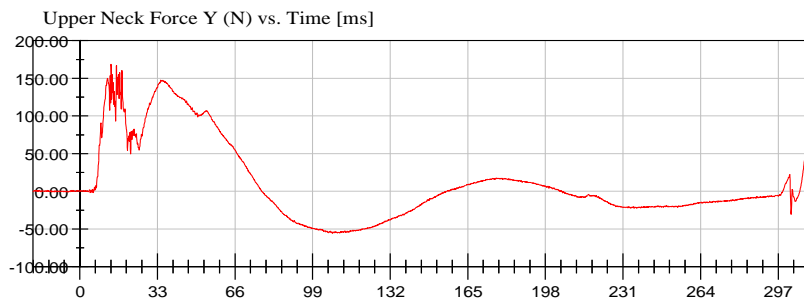
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53.03 N at 310.00 ms

**<Min>**

-184.73 N at 12.80 ms

CFC\_1000



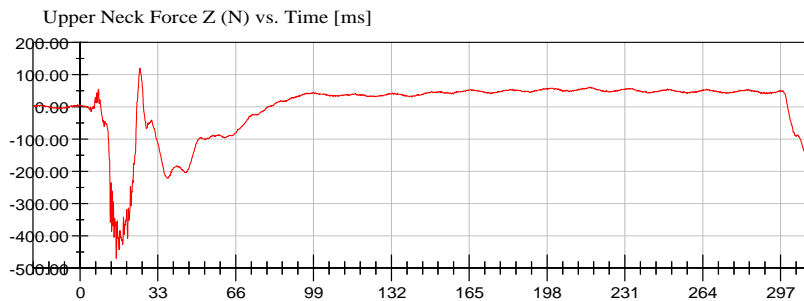
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168.58 N at 13.28 ms

**<Min>**

-56.23 N at 107.44 ms

CFC\_1000



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120.52 N at 25.36 ms

**<Min>**

-470.39 N at 15.44 ms

CFC\_1000



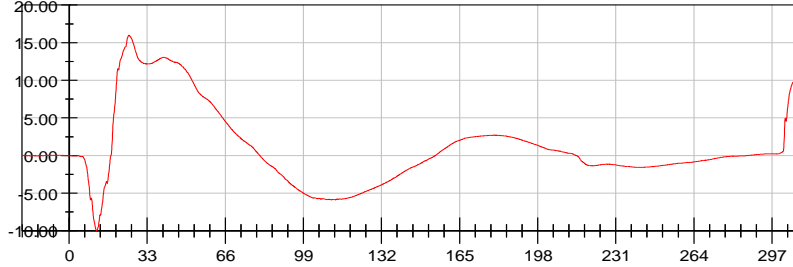
# Alpha Technology

Test Lab: SLED

Test Number: S130408 (MD0307TWG2)

Test Date: 04/08/2013  
Position #2 Hybrid III 6 year old Dummy (Part 572 N) (182)

Upper Neck Moment X (Nm) vs. Time [ms]



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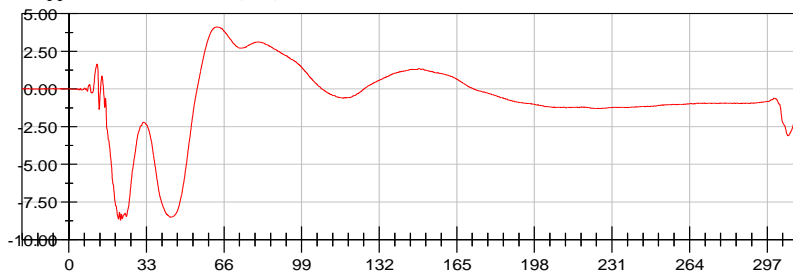
15.99 Nm at 25.28 ms

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-9.99 Nm at 11.60 ms

CFC\_600

Upper Neck Moment Y (Nm) vs. Time [ms]



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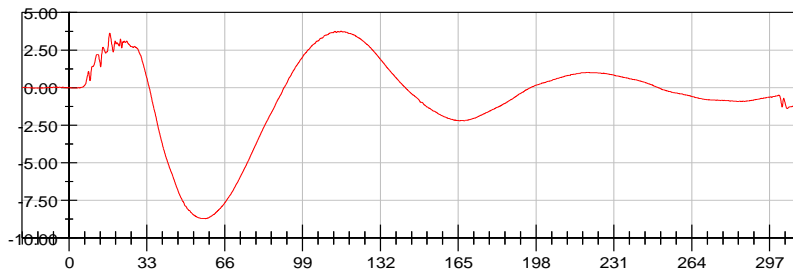
4.11 Nm at 63.04 ms

<Min>

-8.72 Nm at 22.00 ms

CFC\_600

Upper Neck Moment Z (Nm) vs. Time [ms]



<Max>

3.76 Nm at 115.36 ms

<Min>

-8.71 Nm at 57.92 ms

CFC\_600

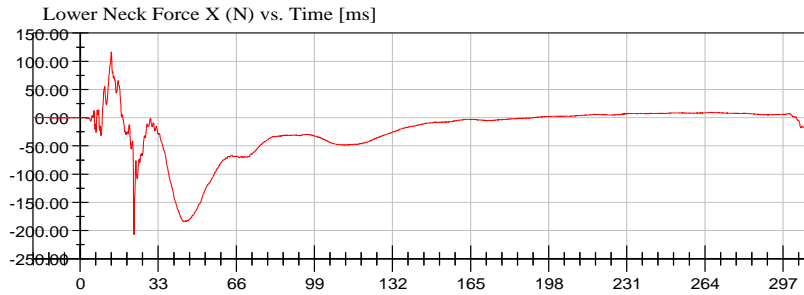


# Alpha Technology

Test Lab: SLED

Test Number: S130408 (MD0307TWG2)

Test Date: 04/08/2013  
Position #2 Hybrid III 6 year old Dummy (Part 572 N) (182)



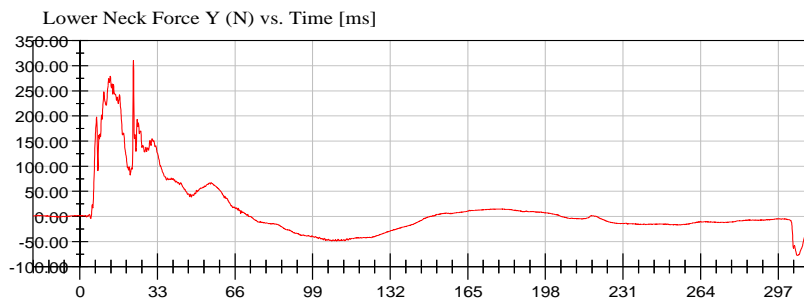
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116.46 N at 13.20 ms

**<Min>**

-207.04 N at 22.72 ms

CFC\_1000



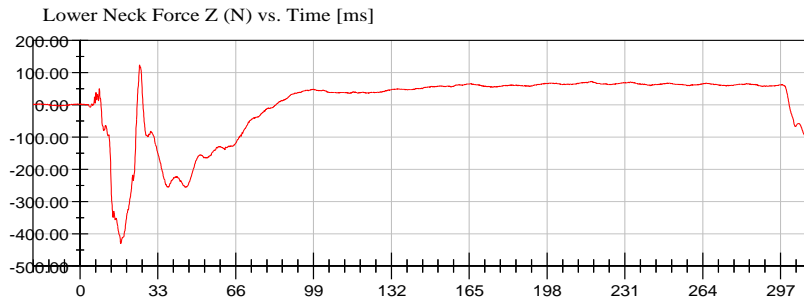
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310.30 N at 22.80 ms

**<Min>**

-78.20 N at 305.04 ms

CFC\_1000



**<Max>**

123.87 N at 25.28 ms

**<Min>**

-430.77 N at 17.28 ms

CFC\_1000



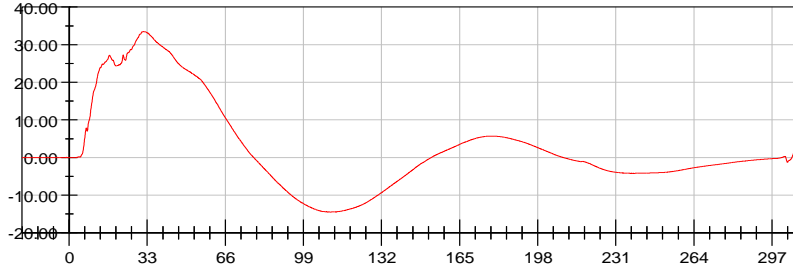
# Alpha Technology

Test Lab: SLED

Test Number: S130408 (MD0307TWG2)

Test Date: 04/08/2013  
Position #2 Hybrid III 6 year old Dummy (Part 572 N) (182)

Lower Neck Moment X (Nm) vs. Time [ms]



<Max>

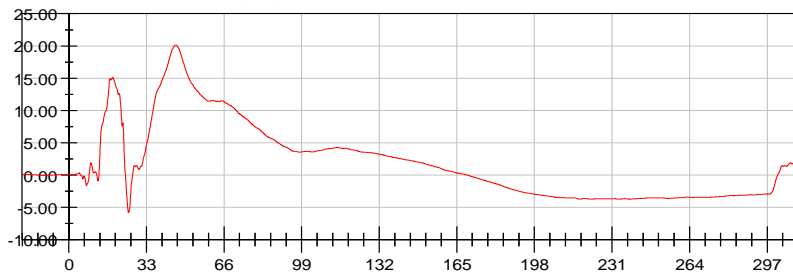
33.49 Nm at 31.52 ms

<Min>

-14.50 Nm at 110.40 ms

CFC\_600

Lower Neck Moment Y (Nm) vs. Time [ms]



<Max>

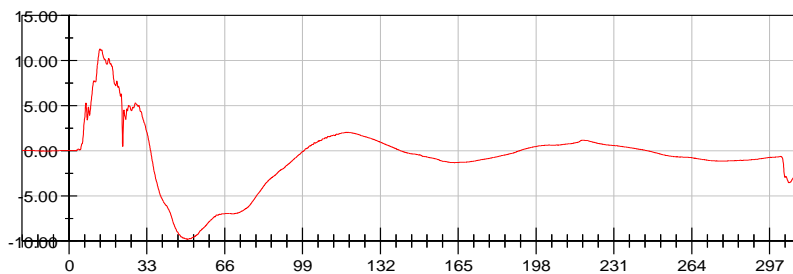
20.11 Nm at 45.60 ms

<Min>

-5.85 Nm at 25.36 ms

CFC\_600

Lower Neck Moment Z (Nm) vs. Time [ms]



<Max>

11.29 Nm at 13.12 ms

<Min>

-9.82 Nm at 50.16 ms

CFC\_600

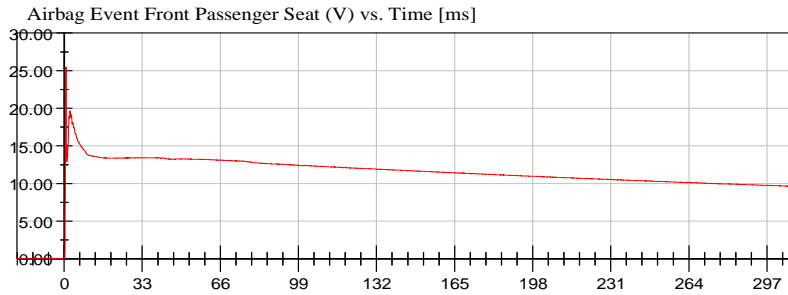


# Alpha Technology

Test Lab: SLED

Test Number: S130408 (MD0307TWG2)

Test Date: 04/08/2013  
Position #2 Hybrid III 6 year old Dummy (Part 572 N) (182)



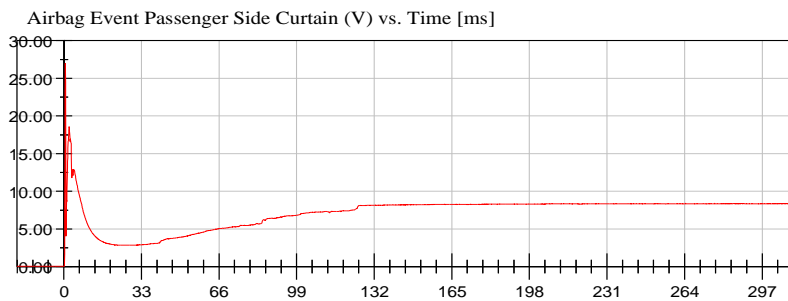
<Max>

25.51 V at 0.72 ms

<Min>

0.00 V at -20.00 ms

CFC\_1000



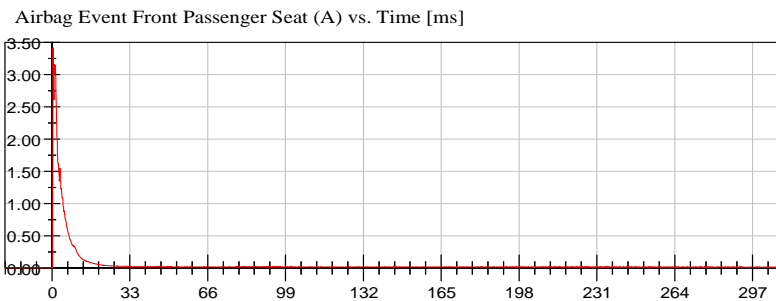
<Max>

26.99 V at 0.64 ms

<Min>

0.00 V at -20.00 ms

CFC\_1000



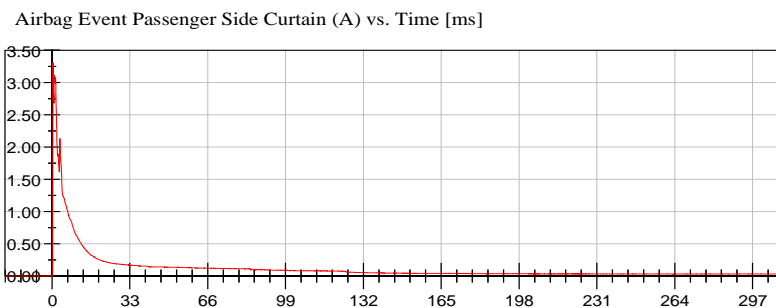
<Max>

3.42 A at 0.48 ms

<Min>

0.00 A at -20.00 ms

CFC\_1000



<Max>

3.30 A at 0.48 ms

<Min>

0.00 A at -20.00 ms

CFC\_1000



Test Vehicle: 2013 Jeep Compass Sport  
Test Program: Side Airbag O.O.P. Injury Testing

NHTSA No.: MD0307TWG2  
Test Date: 4/8/13

## **APPENDIX C**

### **TEST EQUIPMENT LIST AND CALIBRATION INFORMATION**

Test Vehicle: 2013 Jeep Compass Sport  
 Test Program: Side Airbag O.O.P. Injury Testing

NHTSA No.: MD0307TWG2  
 Test Date: 4/8/13

**TEST EQUIPMENT LIST AND CALIBRATION INFORMATION**

**P572N INSTRUMENTATION**

	POSITION #2 (RIGHT) SERIAL NO.: 182		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
Head Accel X	P51954	Endevco	12-Mar-13
Head Accel Y	P63954	Endevco	12-Mar-13
Head Accel Z	P58771	Endevco	12-Mar-13
Upper Neck Force X	1716A-1647-FX	Denton	12-Mar-13
Upper Neck Force Y	1716A-1647-FY	Denton	12-Mar-13
Upper Neck Force Z	1716A-1647-FZ	Denton	12-Mar-13
Upper Neck Moment X	1716A-1647-MX	Denton	12-Mar-13
Upper Neck Moment Y	1716A-1647-MY	Denton	12-Mar-13
Upper Neck Moment Z	1716A-1647-MZ	Denton	12-Mar-13
Lower Neck Force X	2430-180-FX	Denton	3-Oct-12
Lower Neck Force Y	2430-180-FY	Denton	3-Oct-12
Lower Neck Force Z	2430-180-FZ	Denton	3-Oct-12
Lower Neck Moment X	2430-180-MX	Denton	3-Oct-12
Lower Neck Moment Y	2430-180-MY	Denton	3-Oct-12
Lower Neck Moment Z	2430-180-MZ	Denton	3-Oct-12
Airbag Event Front Passenger Seat	K3789-166	KAYSER-THREDE	8-Apr-13
Airbag Event Passenger Side Curtain	K3789-166	KAYSER-THREDE	8-Apr-13
Airbag Event Front Passenger Seat	K3789-166	KAYSER-THREDE	8-Apr-13
Airbag Event Passenger Side Curtain	K3789-166	KAYSER-THREDE	8-Apr-13