



REPORT NUMBER: TWG-MGA-2015-006

**SIDE AIRBAG OUT-OF-POSITION INJURY
TECHNICAL WORKING GROUP**

**FORD MOTOR COMPANY
2015 Ford Expedition XLT EL 4X4 SUV
NHTSA No.: M20150210TWG2**

TEST DATE: MARCH 5, 2015

FINAL REPORT DATE: MARCH 25, 2015

FINAL REPORT

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The results presented in this report relate only to the specified test items.

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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

The purpose of this test was to obtain data in a static out-of-position side air bag deployment. These data constitute part of the general consumer information collected by Alpha Technology Associate, Inc.

SUMMARY

The effects of both a curtain and torso airbag deployment in a 2015 Ford Expedition XLT EL 4x4 SUV with an out-of-position Hybrid III 3-Year-Old child dummy were evaluated. The curtain and seat airbags were fired remotely. The test was performed by MGA Research Corporation on March 5, 2015. Pre-test and post-test photographs of the vehicle and dummy can be found in Appendix A.

Three high-speed cameras (1000 fps) were used to document the side airbag deployment event. The following camera locations were used:

- Left Side Through Removed Driver Door
- Front Through Windshield
- Left Side ¾ View Through Windshield

One Hybrid III 3-Year-Old child dummy (Serial Number 082) was placed in the right front passenger seat situated in the rear-facing position along the outboard edge of the seat per Section 3.3.3.2 according to dummy 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 dummy was instrumented with the following instrumentation:

- Head Accelerations
- Upper Neck Load Cell
- Lower Neck Load Cell
- Chest Accelerations
- Upper Spine Accelerations
- Lower Spine Accelerations
- Upper Sternum Acceleration
- Lower Sternum Acceleration
- Chest Potentiometer

The 27 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy data traces.

The Hybrid III 3-Year-Old child dummy's visible contact points were as follows:

- Curtain bag to left side of head and left shoulder
- Torso bag to left side of head, left shoulder, left torso, and left pelvis

The Hybrid III 3-Year-Old child dummy was placed in the right front passenger seat along the outboard edge of the seat cushion, kneeling and facing rearward. The vertical centerline of the dummy's sternum was aligned as close as possible with the leading edge of the seatback bolster. The sternum contacted with seat. The dummy's head was placed in between the seat bolster and pillar/side trim to maximize contact between the sternum and seatback. The head remained in its neutral orientation. The outboard leg was positioned at the outboard edge of the seat cushion and parallel to the seat centerline and remained on the cushion. The outboard knee and lower leg was slid toward the seatback/seat cushion junction until the top edge of the upper rib was aligned horizontally with the top edge of the airbag module. The inboard leg was aligned parallel to the centerline of the seat cushion. The inboard knee and lower leg was slid toward the seat bight until a line drawn through both shoulder bolts was perpendicular to the vehicle centerline. The inboard arm was rotated towards the seatback until the thumb contacts the seatback. The outboard arm and hand was rotated to hang down as close to vertical as possible.

The dummy's skullcap seam was taped with 4mm electrical tape to prevent the airbag from getting caught in the seam. The dummy's headskin was cleaned with alcohol and dusted with baby powder to achieve acceptable frictional characteristics.

This orientation complies with Section 3.3.3.2 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as defined by Lund, et al and the Technical Working Group First Revision dated July, 2003.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
TEST SUMMARY

	Test Data	Description
Seating Position	P2	Right Front Seating Position
Test	3.3.3.2*	Rear-facing child dummy
Curtain Airbag	Roof-Rail Mounted	Side Airbag
Torso Airbag	Seat Mounted	Side Airbag
ATD Type/Serial No.	Hybrid III 3 Year Old / 082	Child Dummy

* Procedure as defined by Lund, et al and the Technical Working Group dated July, 2003

Number of Dummy Data Channels	27
Number of Airbag Channels	4
Number of High-Speed Videos	3

Visible Dummy Contact Points	
Head Contact	Curtain & Seat Torso/Pelvis bag
Left Shoulder Contact	Curtain & Seat Torso/Pelvis bag
Left Torso Contact	Seat Torso/Pelvis bag
Left Pelvis Contact	Seat Torso/Pelvis bag

DATA SHEET NO. 2

TEST VEHICLE INFORMATION

Please note that this vehicle had previously been tested in an
NCAP Side Impact on December 11, 2014.

TEST VEHICLE INFORMATION

TEST VEHICLE OPTIONS

Manufacturer	Ford	Driver Front Airbag	Yes
Model	Expedition	Driver Side Curtain Airbag	Yes
Body Style	SUV	Driver Side Torso/Pelvis Airbag	Yes
NHTSA No.	M20150210	Rear Passenger Side Curtain Airbag	Yes
VIN	1FMJK1JT2FEF06501	Rear Passenger Side Torso/Pelvis Airbag	No
Color	Blue Jeans Metallic	Force Limiter	Yes
Delivery Date	11/11/2014	Pretensioner	Yes
Odometer Reading (mile)	17	Power Steering	Yes
Dealer	Suburban Ford of Sterling Heights	Power Door Locks	Yes
Transmission	Automatic	Tilt Wheel	Yes
Final Drive	4WD	Air Conditioning	Yes
Number of Cylinders	6	Anti-lock Brakes	Yes
Engine Displacement (L)	3.5	Traction Control	Yes
Engine Placement	Longitudinal	All-Wheel Drive	No
Automatic Door Lock (ADL)	Yes	Power Seats	No
Owner's Manual Details Instructions on Disabling ADLs	Yes		
Bucket Seats	Yes		

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Company	GVWR (kg)	3520
Date of Manufacture	09/14	GAWR Front (kg)	1678
		GAWR Rear (kg)	1950

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	Split Bench	
Number of Occupants	2	3	3	8
Capacity Wt. (VCW) (kg)				703
Cargo Wt. (RCLW) (kg)				159

DATA SHEET NO. 3
DUMMY POSITIONING IN VEHICLE

Measurement		Value
Seat Position		Full Forward
Seat Height Position		Non-Adjustable
Placed in Position No. 2		---
Seat Back Angle (at headrest post)	SA (°)	10.2
Top of Curtain Airbag Module to Head/Neck Junction	AN (mm)	322
Top of Seat Airbag Module to Head/Neck Junction	AN (mm)	115
Head CG to Window	HD (mm)	200
Head to Seat Back Centerline	HSC (mm)	177
Back to Dash	CD (mm)	468
Chest to Seatback	CS (mm)	Contact
Right Arm to Seat Back Centerline	RACL (mm)	82
Left Arm to Seat Back Centerline	LACL (mm)	294
Right Arm to Window	RA (mm)	306
Left Arm to B-Post	LA (mm)	142
Knee to Knee	KK (mm)	N/A
Toe to Toe	TT (mm)	115
Right Knee to Seat Cushion Centerline	KSCR (mm)	122
Left Knee to Seat Cushion Centerline	KSCL (mm)	259
Right Toe to Seat Cushion Centerline	TSCR (mm)	100
Left Toe to Seat Cushion Centerline	TSCL (mm)	205
Nose to Dash	ND (mm)	727
Nose to Seatback	NS (mm)	Contact
Top of Head to Headliner	HH (mm)	229

DATA SHEET NO. 4
DUMMY INJURY CRITERIA VALUES

NHTSA No.: M20150210TWG2

DESCRIPTION	UNIT	MAXIMUM VALUE			
		Position No. 2			
		MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Head X	g	4.2	11.3	-6.4	29.6
Head Y	g	14.3	26.5	-4.9	34.3
Head Z	g	11.8	14.2	-1.8	71.1
Head Resultant	g	14.9	26.4		
Upper Neck Fx	N	88.3	11.3	-138.6	17.7
Upper Neck Fy	N	38.9	50.7	-187.4	33.9
Upper Neck Fz	N	293.4	14.4	-199.5	34.6
Upper Neck F Resultant	N	306.4	14.5		
Upper Neck Mx	Nm	3.3	87.6	-16.9	27.1
Upper Neck My	Nm	5.9	76.3	-10.7	16.5
Upper Neck Mz	Nm	2.7	60.7	-3.2	87.0
Upper Neck M Resultant	Nm	17.5	27.1		
Lower Neck Fx	N	125.9	10.4	-174.7	15.4
Lower Neck Fy	N	58.2	94.3	-227.9	22.0
Lower Neck Fz	N	372.0	14.6	-193.8	34.5
Lower Neck F Resultant	N	404.0	14.6		
Lower Neck Mx	Nm	8.2	85.7	-25.3	33.0
Lower Neck My	Nm	12.9	67.4	-7.1	10.3
Lower Neck Mz	Nm	2.4	61.9	-6.7	23.5
Lower Neck M Resultant	Nm	26.9	33.0		
Chest X	G	2.2	71.2	-19.2	10.3
Chest Y	G	14.6	10.3	-4.3	21.8
Chest Z	G	2.4	13.4	-1.0	92.4
Chest Resultant	G	24.1	10.3		
Upper Spine X	G	3.5	8.3	-18.3	12.3
Upper Spine Y	G	18.9	14.1	-8.7	21.9
Upper Spine Z	G	9.8	13.0	-5.9	8.8
Upper Spine Resultant	G	24.4	13.8		
Lower Spine X	G	3.5	22.8	-29.7	10.1
Lower Spine Y	G	23.8	10.6	-6.7	22.3
Lower Spine Z	G	9.8	10.5	-1.7	70.9
Lower Spine Resultant	G	38.4	10.3		
Upper Sternum X	G	86.3	13.0	-160.5	7.5
Lower Sternum X	G	131.0	12.5	-145.3	7.1
Chest Displacement	mm			-5.4	12.9

DATA SHEET NO. 4 (continued)
DUMMY INJURY CRITERIA VALUES

NHTSA No.: M20150210TWG2

ATD position	HEAD INJURY CRITERIA (HIC)					
	HIC15			HIC36		
	HIC	T ¹ (msec)	T ² (msec)	HIC	T ¹ (msec)	T ² (msec)
No. 2 Right Front	3.74	13.8	28.8	4.77	17.9	53.9

Position 2 Neck Injury Summary (3-Year-Old – Out-Of-Position)

	Nij	Time (msec)	Z Force (N) (CFC 600)	X Force (N) (CFC 600)	Y Moment (N-m) (CFC 600)
Ntf	0.12	11.5	173.69	81.45	2.89
Nte	0.49	16.1	218.11	-127.66	-10.34
Ncf	0.12	51.6	-98.73	-78.99	4.94
Nce	0.27	23.8	-181.75	-68.53	-5.02
Peak Tension (CFC1000)		293.4 N	Peak Compression (CFC 1000)		-199.5 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2120 N	Extension (mCVe)	27 N-m	Tension	1130 N
Compression (CVc)	2120 N	Flexion (mCVf)	68 N-m	Compression	1380 N

APPENDIX A
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Photo No. 1 - Right 3/4 Front View of Vehicle, As Received



Photo No. 2 - Vehicle Certification Placard



Photo No. 3 - Pre-Test Vehicle Left Side View



Photo No. 4 - Post-Test Vehicle Left Side View



Photo No. 5 - Pre-Test 3-Year-Old Child Dummy Left Side View



Photo No. 6 - Post-Test 3-Year-Old Child Dummy Left Side View



Photo No. 7 - Pre-Test 3-Year-Old Child Dummy Left Side Closeup View

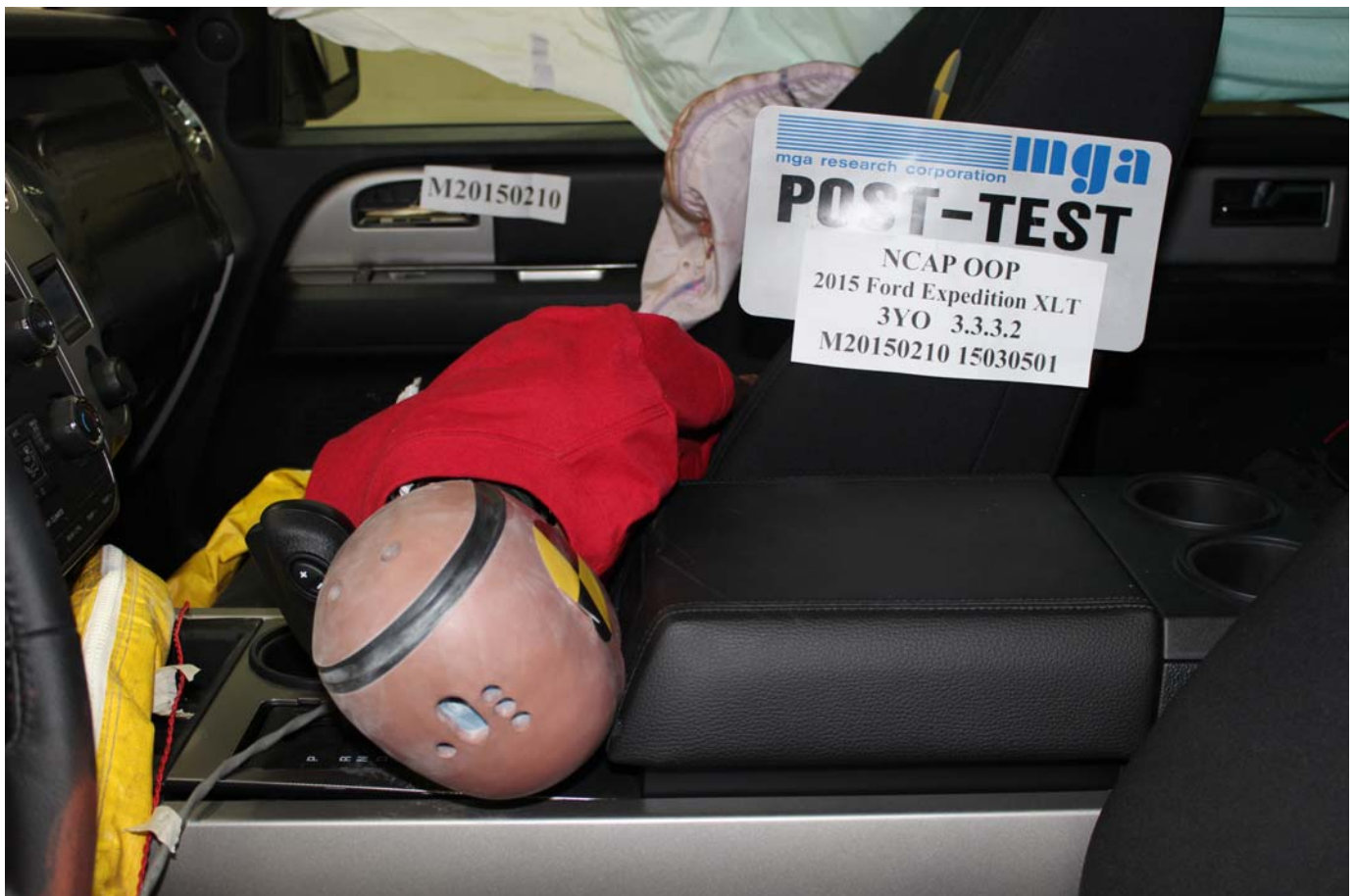


Photo No. 8 - Post-Test 3-Year-Old Child Dummy Left Side Closeup View

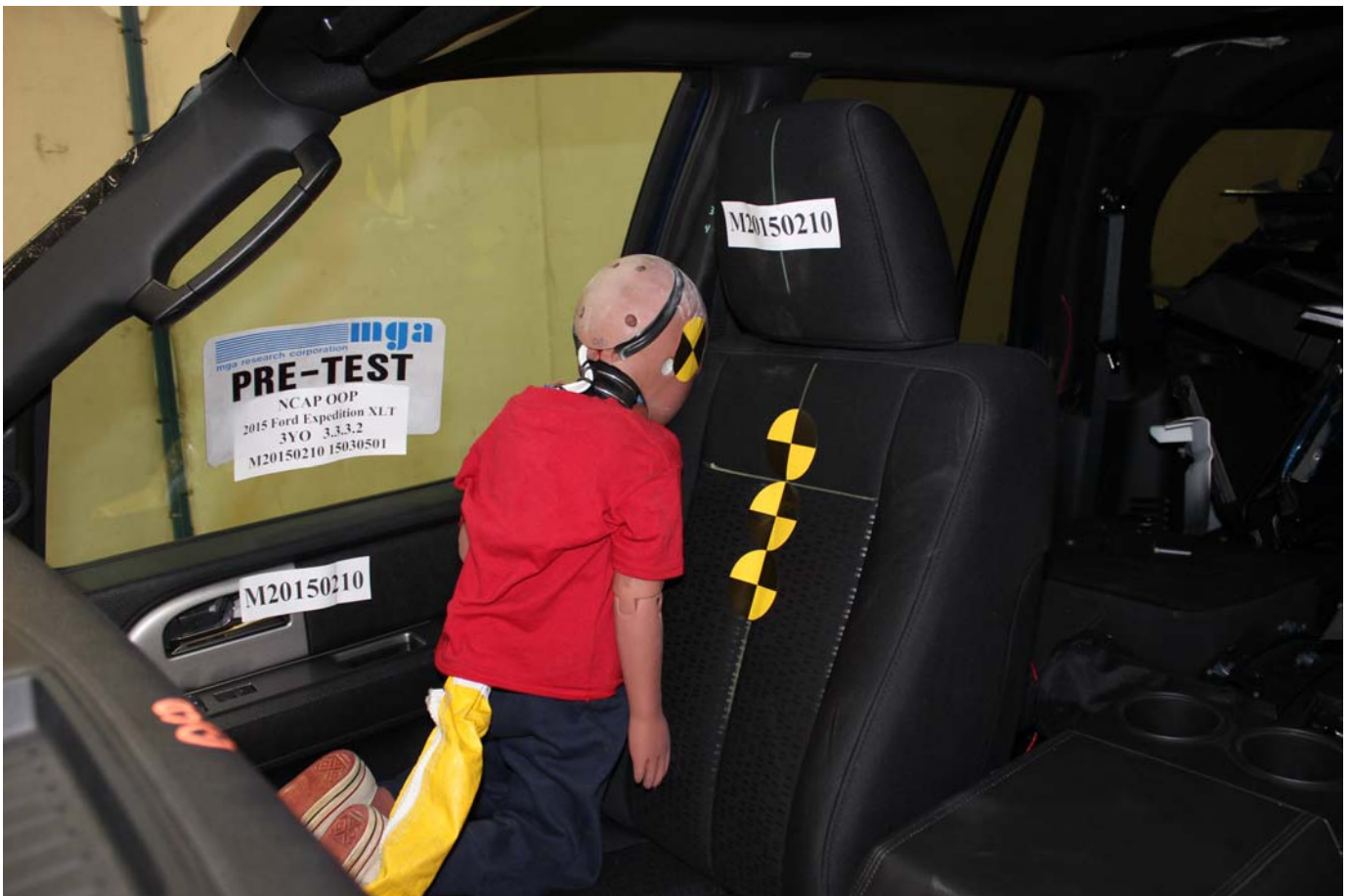


Photo No. 9 - Pre-Test 3-Year-Old Child Dummy Left $\frac{3}{4}$ Front View



Photo No. 10 - Post-Test 3-Year-Old Child Dummy Left $\frac{3}{4}$ Front View



Photo No. 11 - Pre-Test 3-Year-Old Child Dummy Left ¾ Front Closeup View



Photo No. 12 - Post-Test 3-Year-Old Child Dummy Left ¾ Front Closeup View



Photo No. 13 - Pre-Test 3-Year-Old Child Dummy Front View



Photo No. 14 - Post-Test 3-Year-Old Child Dummy Front View

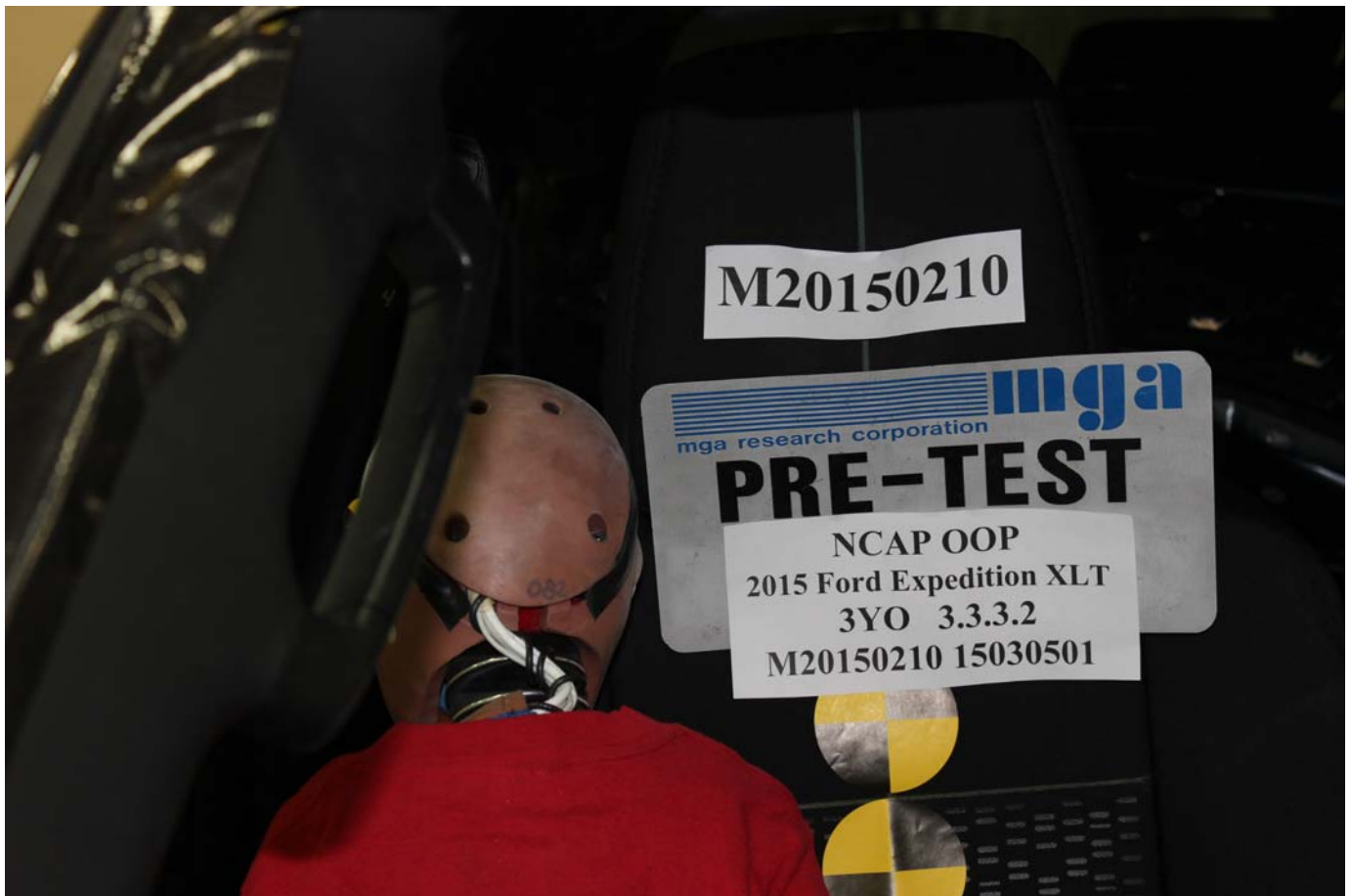


Photo No. 15 - Pre-Test 3-Year-Old Child Dummy Front Closeup View

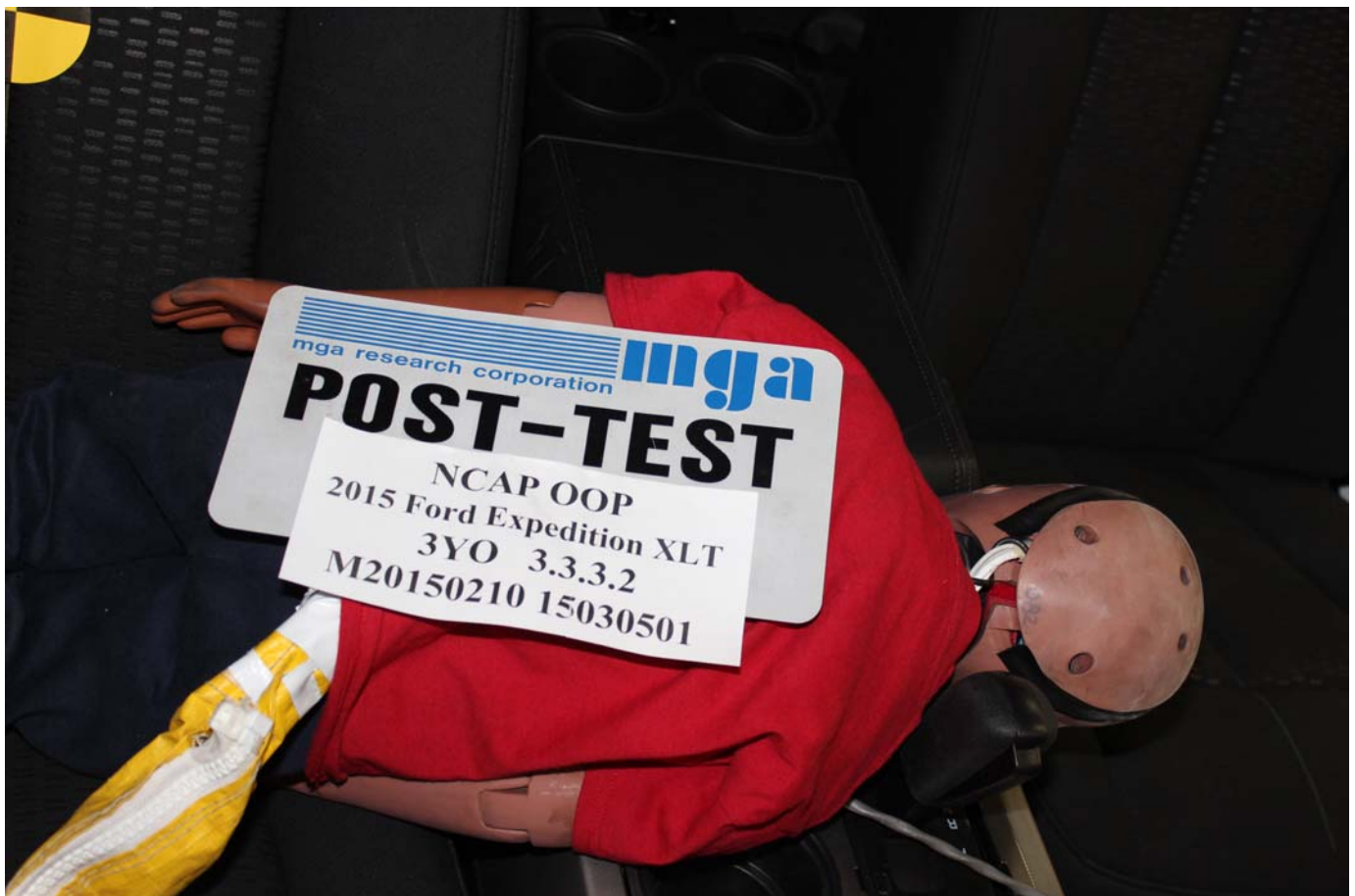


Photo No. 16 - Post-Test 3-Year-Old Child Dummy Front Closeup View



Photo No. 17 - Pre-Test 3-Year-Old Child Dummy Right ¾ Front View



Photo No. 18 - Post-Test 3-Year-Old Child Dummy Right ¾ Front View



Photo No. 19 - Pre-Test 3-Year-Old Child Dummy Right Side View



Photo No. 20 - Post-Test 3-Year-Old Child Dummy Right Side View



Photo No. 21 - Post-Test 3-Year-Old Child Dummy Right Side View (Door Open)



Photo No. 22 - Post-Test Curtain Airbag Left Side View



Photo No. 23 - Post-Test Curtain Airbag Left 3/4 Front View



Photo No. 24 - Post-Test Curtain Airbag Front View



Photo No. 25 - Post-Test Curtain Airbag Right Side View (Door Open)

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