

REPORT NUMBER: TWG-MGA-2015-001

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

**FORD MOTOR COMPANY
2015 Lincoln MKC AWD SUV
NHTSA No.: M20150200TWG2**

TEST DATE: DECEMBER 3, 2014

FINAL REPORT DATE: DECEMBER 30, 2014

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 Lincoln MKC AWD SUV with an out-of-position SID-IIs Build Level D were evaluated. The curtain and seat airbags were fired remotely. The test was performed by MGA Research Corporation on December 3, 2014. 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 $\frac{3}{4}$ View Through Windshield

One SID-IIs Build Level D dummy (Serial Number 304) was placed in the right front passenger seat situated in the inboard-facing position per Section 3.3.5.3 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

The 9 channels of data were recorded using an on-board data acquisition system. Appendix B contains the dummy data traces.

The SID-IIs dummy's visible contact points were as follows:

- Curtain airbag to top and back of head
- Torso bag to left torso and left pelvis

The SID-IIs dummy was placed in the right front passenger seat facing toward the center of the vehicle with its arm against the seatback. The arm was rotated horizontally in the forward direction with respect to the dummy. The seat track was adjusted forward to minimize the vertical distance between the dummy's head and curtain airbag. The dummy's pelvis was slid outboard until the dummy's back contacted the door trim panel or armrest and the CG of the head was centered in the deployment trajectory of the airbag. The vertical plane through the centerline of the dummy's rib-stiffener and shoulder bolt was parallel to the centerline of the vehicle. Masking tape was wrapped around the dummy's neck bracket to hold the dummy in place.

This orientation complies with Section 3.3.5.3 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	3.3.5.3*	Inboard Facing SID-IIs dummy
Curtain Airbag	Roof-Rail Mounted	Side Airbag
Torso Airbag	Seat Mounted	Side Airbag
ATD Type/Serial No.	SID-IIs Build Level D / 304	5 th Percentile Adult Female

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

Number of Data Channels	9
Number of Airbag Channels	4
Number of High-Speed Videos	3

Visible Dummy Contact Points	
Head Contact	Curtain airbag top and back of head
Left Shoulder Contact	None
Left Torso Contact	Torso bag
Left Pelvis Contact	Torso bag

DATA SHEET NO. 2

TEST VEHICLE INFORMATION

Please note that this vehicle had previously been tested in an
NCAP Frontal Impact on September 10, 2014.

TEST VEHICLE INFORMATION		TEST VEHICLE OPTIONS	
Manufacturer	Lincoln	Driver Front Airbag	Yes
Model	MKC	Driver Side Curtain Airbag	Yes
Body Style	SUV	Driver Side Torso/Pelvis Airbag	Yes
NHTSA No.	M20150200	Rear Passenger Side Curtain Airbag	Yes
VIN	5LMTJ2AH1FUJ01245	Rear Passenger Side Torso Airbag	No
Color	Midnight Sapphire Metallic	Force Limiter	Yes
Delivery Date	08/06/2014	Pretensioner	Yes
Odometer Reading (mile)	147	Power Steering	Yes
Dealer	Zeisloft Bros. Ford-Lincoln	Power Door Locks	Yes
Transmission	Automatic	Tilt Wheel	Yes
Final Drive	AWD	Air Conditioning	Yes
Number of Cylinders	4	Anti-lock Brakes	Yes
Engine Displacement (L)	2.3	Traction Control	Yes
Engine Placement	Lateral	All-Wheel Drive	Yes
Automatic Door Lock (ADL)	Yes	Power Seats	Yes
Owner's Manual Details Instructions on Disabling ADLs	Yes		
Bucket Seats	Yes		

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Company	GVWR (kg)	2277
Date of Manufacture	05/14	GAWR Front (kg)	1198
		GAWR Rear (kg)	1089

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				375
Cargo Wt. (RCLW) (kg)				35

DATA SHEET NO. 3
DUMMY POSITIONING IN VEHICLE

Measurement		Value
Seat Position		128 mm of 254 mm from Full Forward
Seat Height Position		Lowest
Placed in Position No. 2		---
Seat Back Angle (at headrest post)	SA (°)	5.1
Top of Curtain Airbag Module to Head/Neck Junction	AN (mm)	241
Top of Seat Airbag Module to Head/Neck Junction	AN (mm)	173
Head CG to Door Window	HD (mm)	187
Head to Seat Back Centerline	HSC (mm)	255
Chest to Dash	CD (mm)	441
Chest to Seatback	CS (mm)	267
Right Arm to Seat Back Centerline	RACL (mm)	---
Left Arm to Seat Back Centerline	LACL (mm)	280
Right Arm to Door Panel	RA (mm)	---
Left Arm to Door Panel	LA (mm)	89
Knee to Knee	KK (mm)	129
Toe to Toe	TT (mm)	72
Right Knee to Seat Cushion Centerline	KSCR (mm)	142
Left Knee to Seat Cushion Centerline	KSCL (mm)	116
Right Toe to Seat Cushion Centerline	TSCR (mm)	671
Left Toe to Seat Cushion Centerline	TSCL (mm)	537
Nose to Dash	ND (mm)	600
Nose to Headrest	NS (mm)	271
Top of Head to Headliner	HH (mm)	89

DATA SHEET NO. 4
DUMMY INJURY CRITERIA VALUES

NHTSA No. M20150200TWG2

		MAXIMUM VALUE			
		Position No. 2			
DESCRIPTION	UNIT	MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Head X	g	28.1	10.4	-4.6	57.3
Head Y	g	17.7	18.0	-19.8	10.7
Head Z	g	76.3	10.2	-12.4	20.3
Head Resultant	g	77.9	10.2		
Upper Neck Fx	N	26.3	291.9	-328.3	34.8
Upper Neck Fy	N	39.1	185.7	-223.7	25.5
Upper Neck Fz	N	211.8	297.6	-1481.4	19.8
Upper Neck F Resultant	N	1495.0	19.8		
Upper Neck Mx	Nm	25.8	25.6	-5.2	108.0
Upper Neck My	Nm	12.4	66.0	-22.6	31.9
Upper Neck Mz	Nm	5.1	37.8	-5.9	85.3
Upper Neck M Resultant	Nm	34.1	25.5		

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

NHTSA No. M20150200TWG2

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	16.83	9.9	24.9	20.94	9.9	35.7

Position 2 Neck Injury Summary (SID-IIs Build Level D – Out-Of-Position)

	Nij	Time (msec)	Z Force (N) (CFC 600)	X Force (N) (CFC 600)	Y Moment (N-m) (CFC 600)
Ntf	0.06	83.1	4.16	-103.84	7.28
Nte	0.08	300.0	182.92	-17.94	-2.49
Ncf	0.20	11.5	-784.45	-19.10	-0.23
Nce	0.54	21.3	-1355.06	-220.38	-16.58
Peak Tension (CFC1000)	211.8 N		Peak Compression (CFC 1000)		-1481.4 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	3880 N	Extension (mCVe)	61 N-m	Tension	2070 N
Compression (CVc)	3880 N	Flexion (mCVf)	155 N-m	Compression	2520 N
Condyle Offset	0.01778 m				

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Right ¾ Front View of Vehicle, As Received



Vehicle Certification Placard



Pre-Test Vehicle Left Side View



Post-Test Vehicle Left Side View



Pre-Test SID-IIs Dummy Left Side View



Post-Test SID-IIs Dummy Left Side View



Pre-Test SID-IIs Dummy Left Side Closeup View



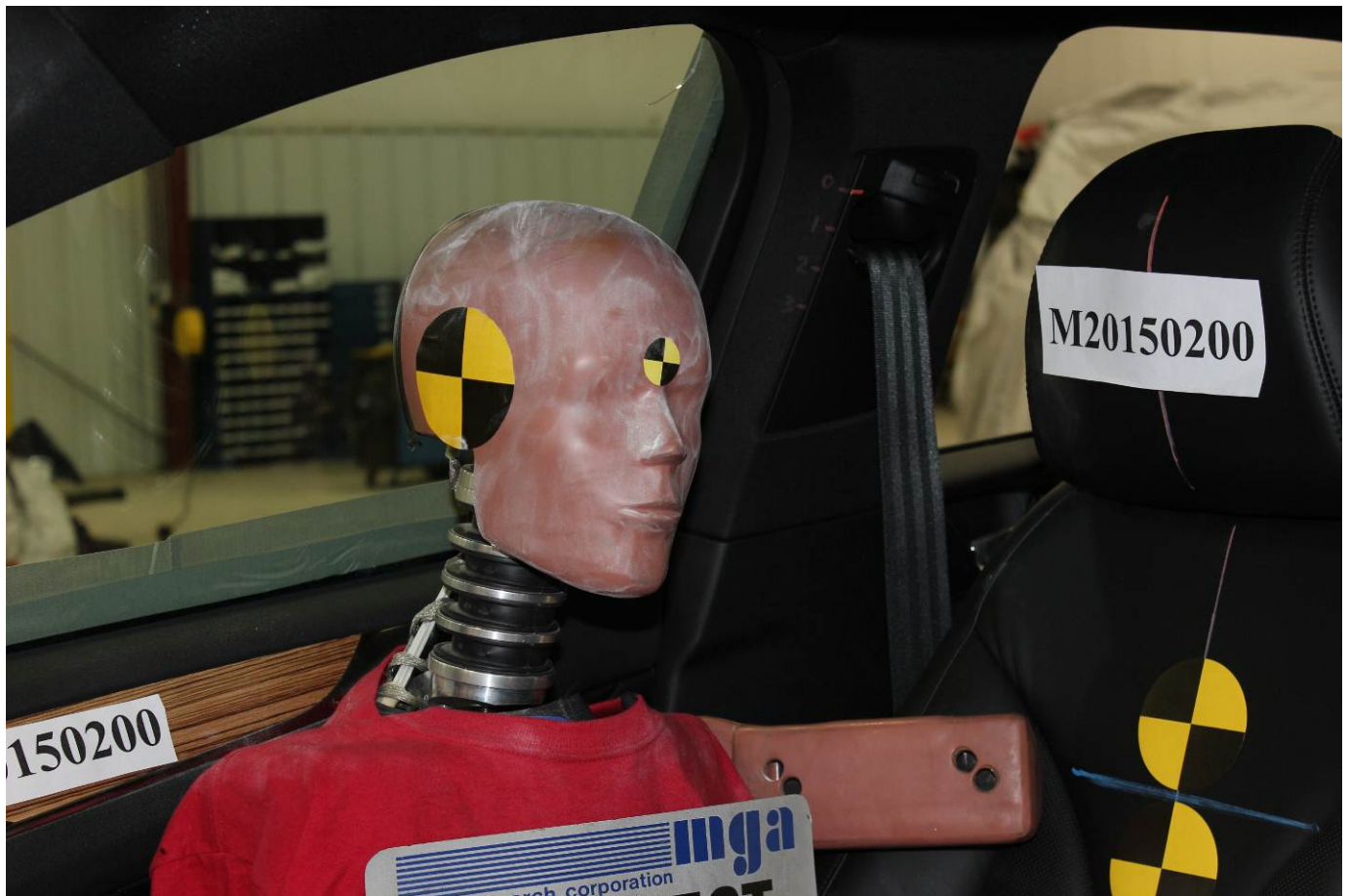
Post-Test SID-IIs Dummy Left Side Closeup View



Pre-Test SID-IIs Dummy Left ¾ Front View



Post-Test SID-IIs Dummy Left ¾ Front View



Pre-Test SID-IIs Dummy Left $\frac{3}{4}$ Front Closeup View



Post-Test SID-IIs Dummy Left $\frac{3}{4}$ Front Closeup View



Pre-Test SID-IIs Dummy Front View



Post-Test SID-IIs Dummy Front View



Pre-Test SID-IIs Dummy Front Closeup View



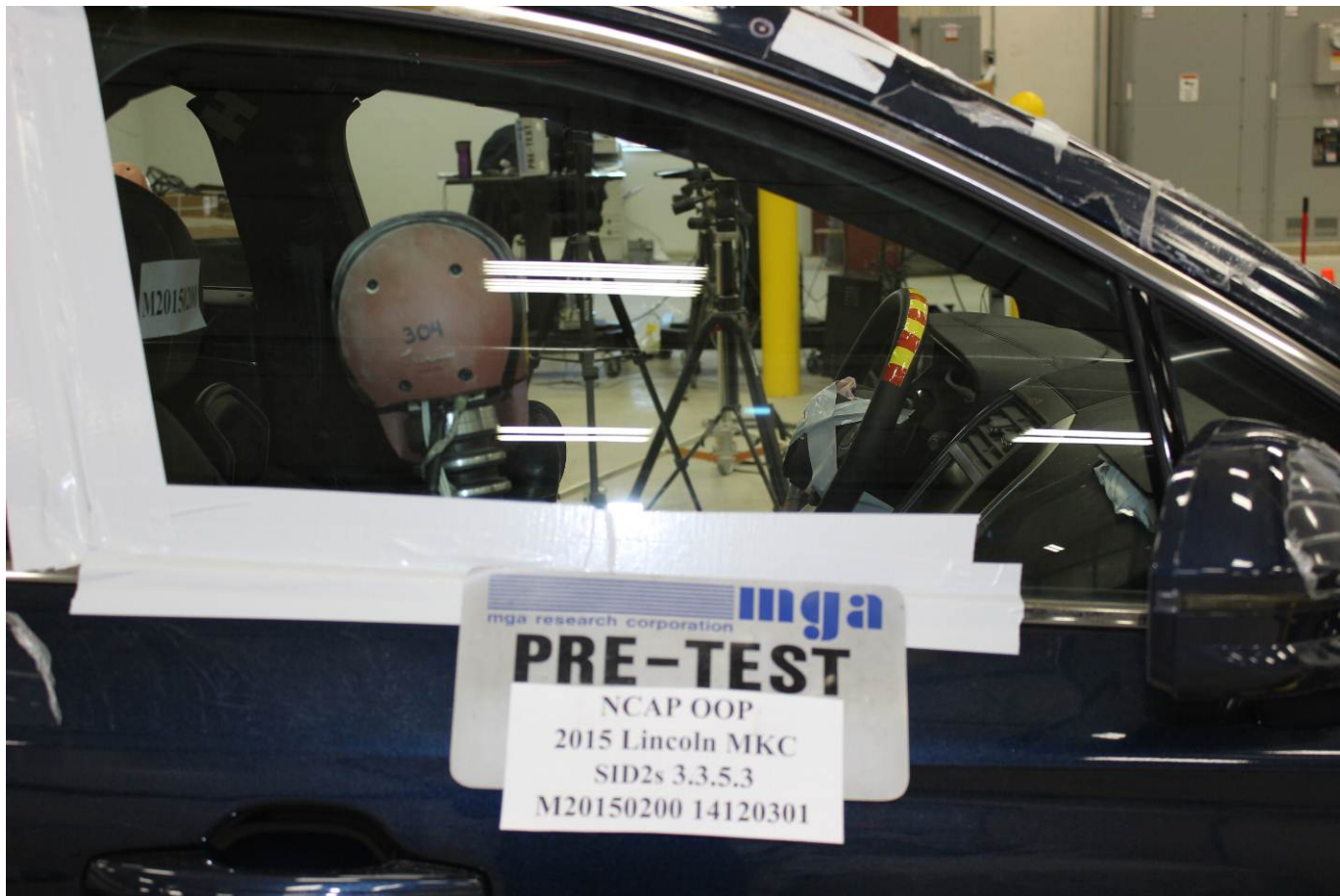
Post-Test SID-IIs Dummy Front Closeup View



Pre-Test SID-IIs Dummy Right $\frac{3}{4}$ Front View



Post-Test SID-IIs Dummy Right $\frac{3}{4}$ Front View



Pre-Test SID-IIs Dummy Right Side View



Post-Test SID-IIs Dummy Right Side View



Post-Test SID-II's Dummy Right Side View (Door Open)



Post-Test Curtain Airbag Left Side View



Post-Test Curtain Airbag Left 3/4 Front View



Post-Test Curtain Airbag Front View



Post-Test Curtain Airbag Right Side View (Door Open)

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