

EliteTM
PRO SERVICE

A PEER GROUP OF THE INDUSTRY'S TOP SHOP OWNERS

2019 Leadership Conference



It's all about
Exceptionalism
So let's start!



Prospering in a Connected Eco-system & Managing New Vehicle Technologies

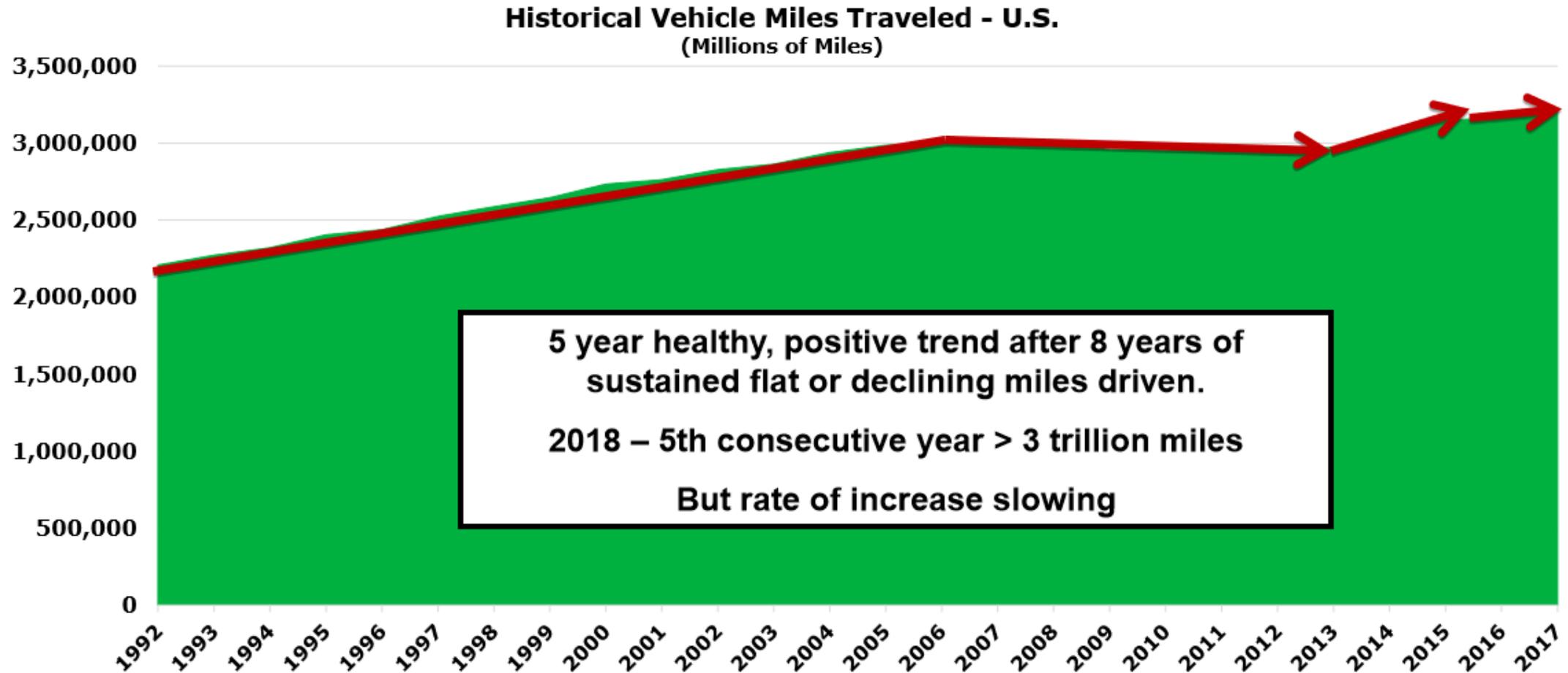
January 23, 2019

Agenda

1. Update on Industry Trends
2. Focus on ADAS and ramp-up technologies
3. Connectivity Trends

UPDATE ON INDUSTRY TRENDS

U.S. Driving Volume (all vehicles)

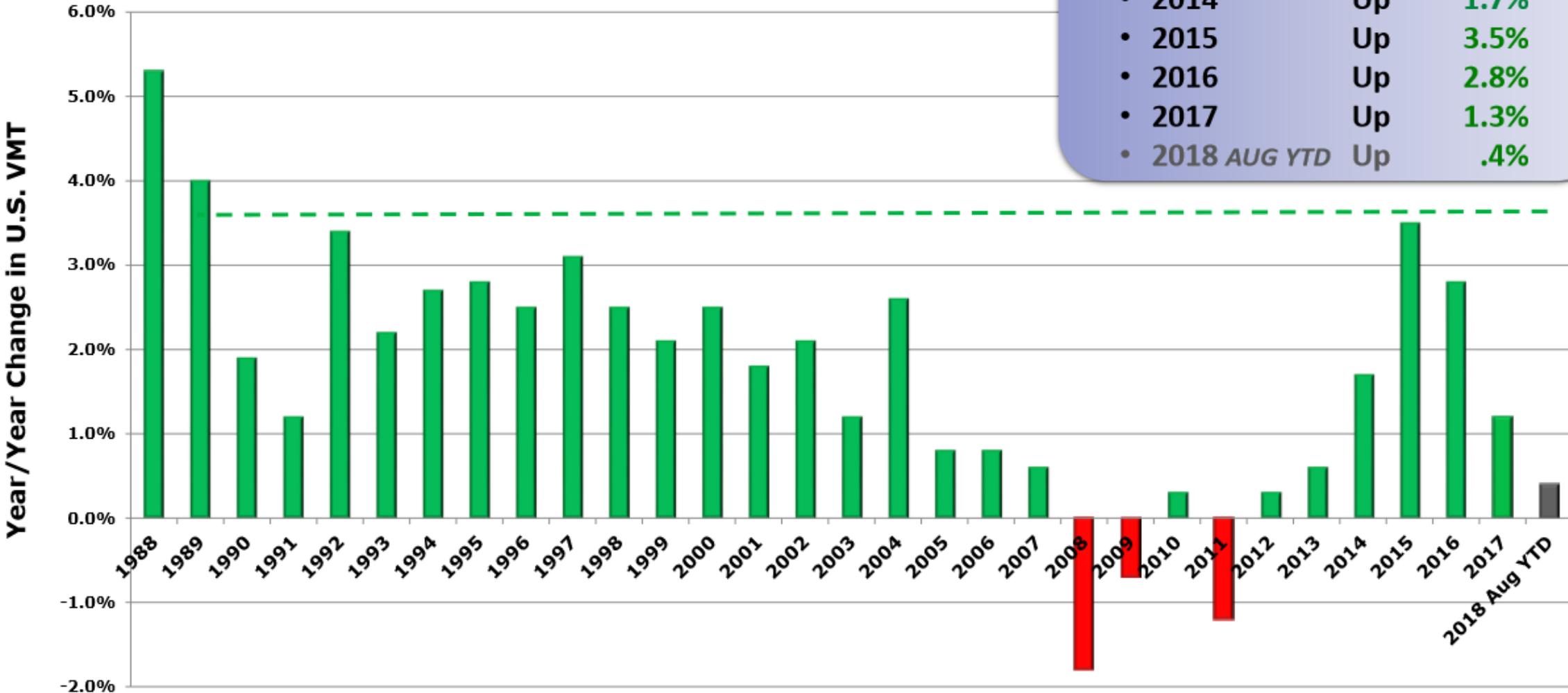


Source: DOT and FHWA

© 2018 IHS Markit. All Rights Reserved.

U.S. Driving Volume is Up – *but slowing*

• 2012	Up	0.3%
• 2013	Up	0.6%
• 2014	Up	1.7%
• 2015	Up	3.5%
• 2016	Up	2.8%
• 2017	Up	1.3%
• 2018 AUG YTD	Up	.4%



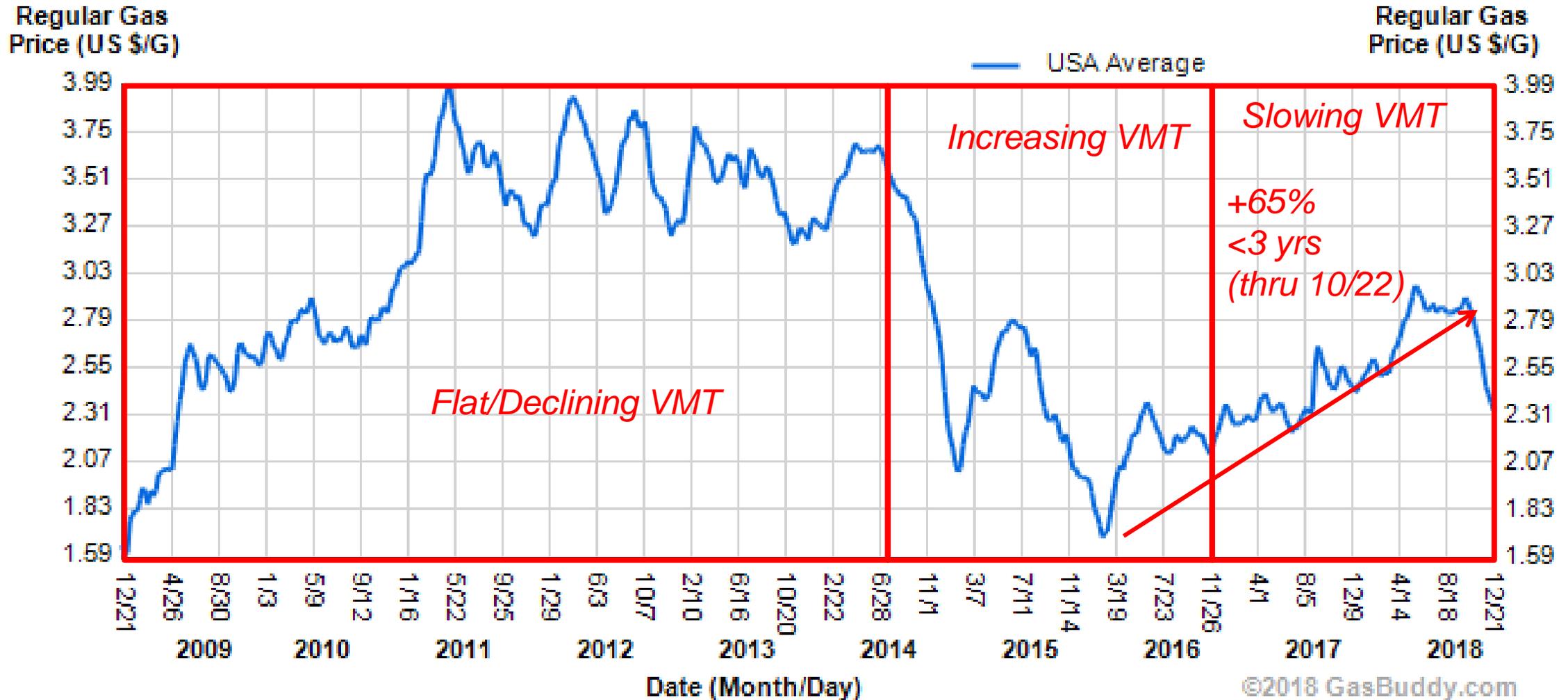
© 2018 IHS Markit. All Rights Reserved.

Source: DOT and FHWA



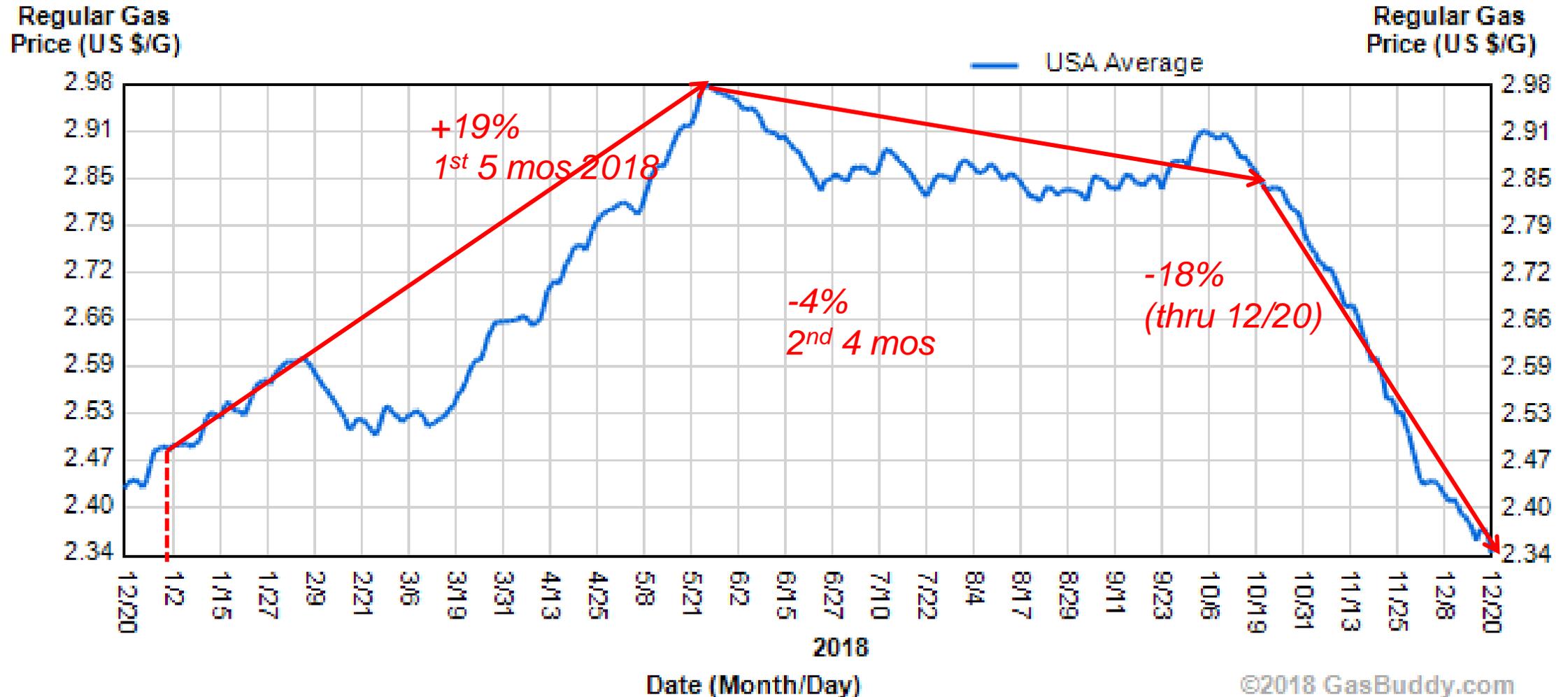
VMT Success Linked to Gas Prices

120 Month Average Retail Price Chart



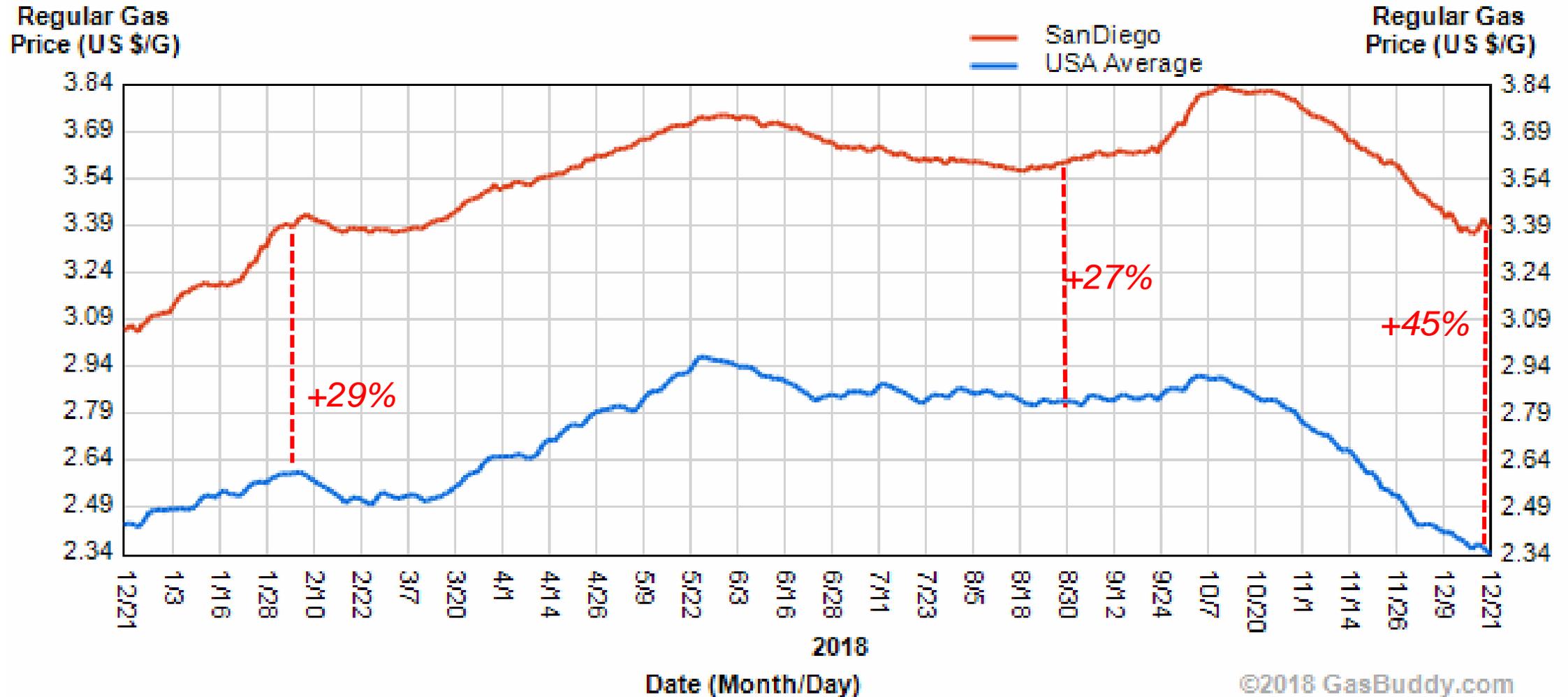
VMT Success Linked to Gas Prices

12 Month Average Retail Price Chart



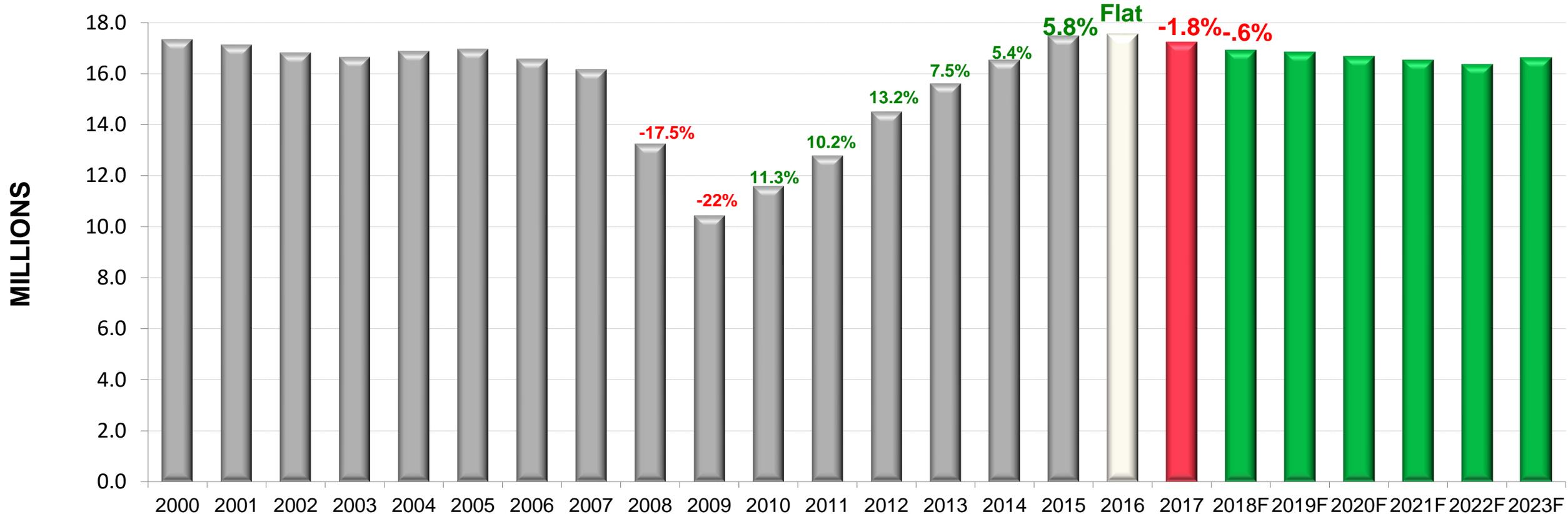
VMT Success Linked to Gas Prices

12 Month Average Retail Price Chart



U.S. Light Vehicle Sales

2018 = 17.1 million units

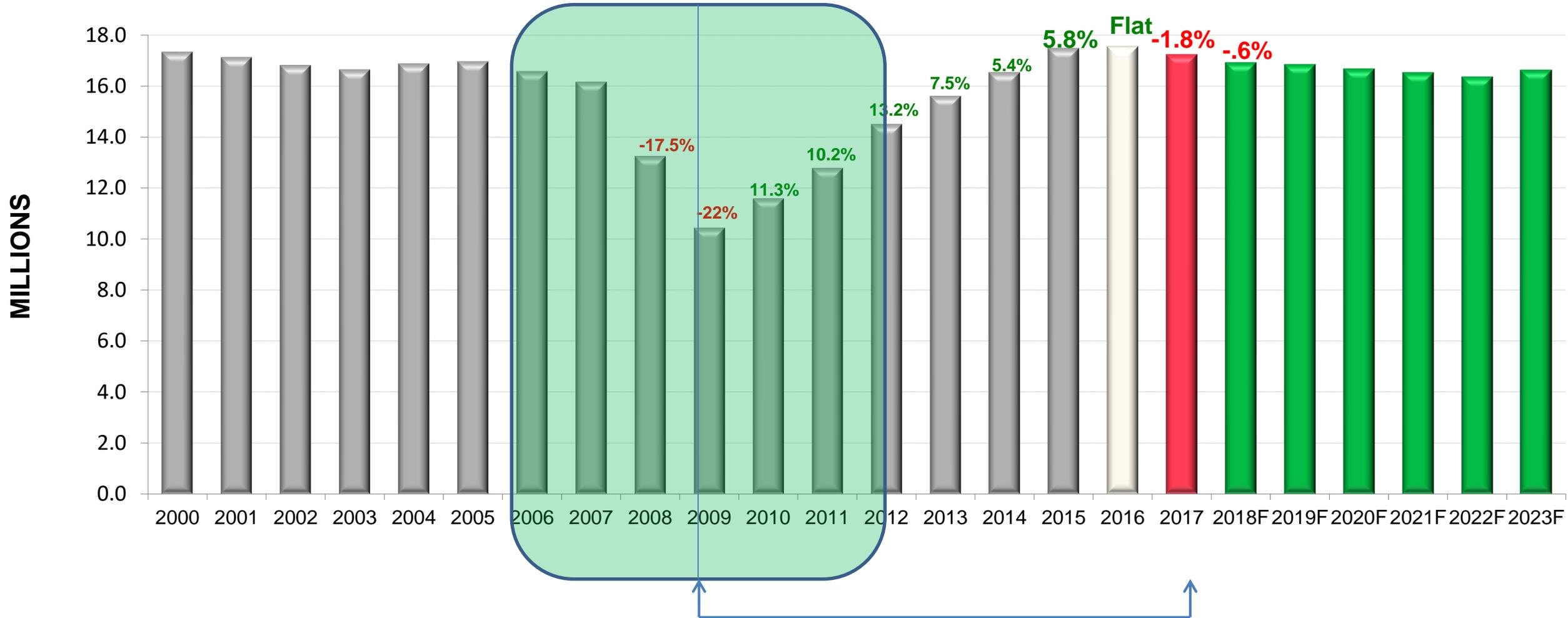


History

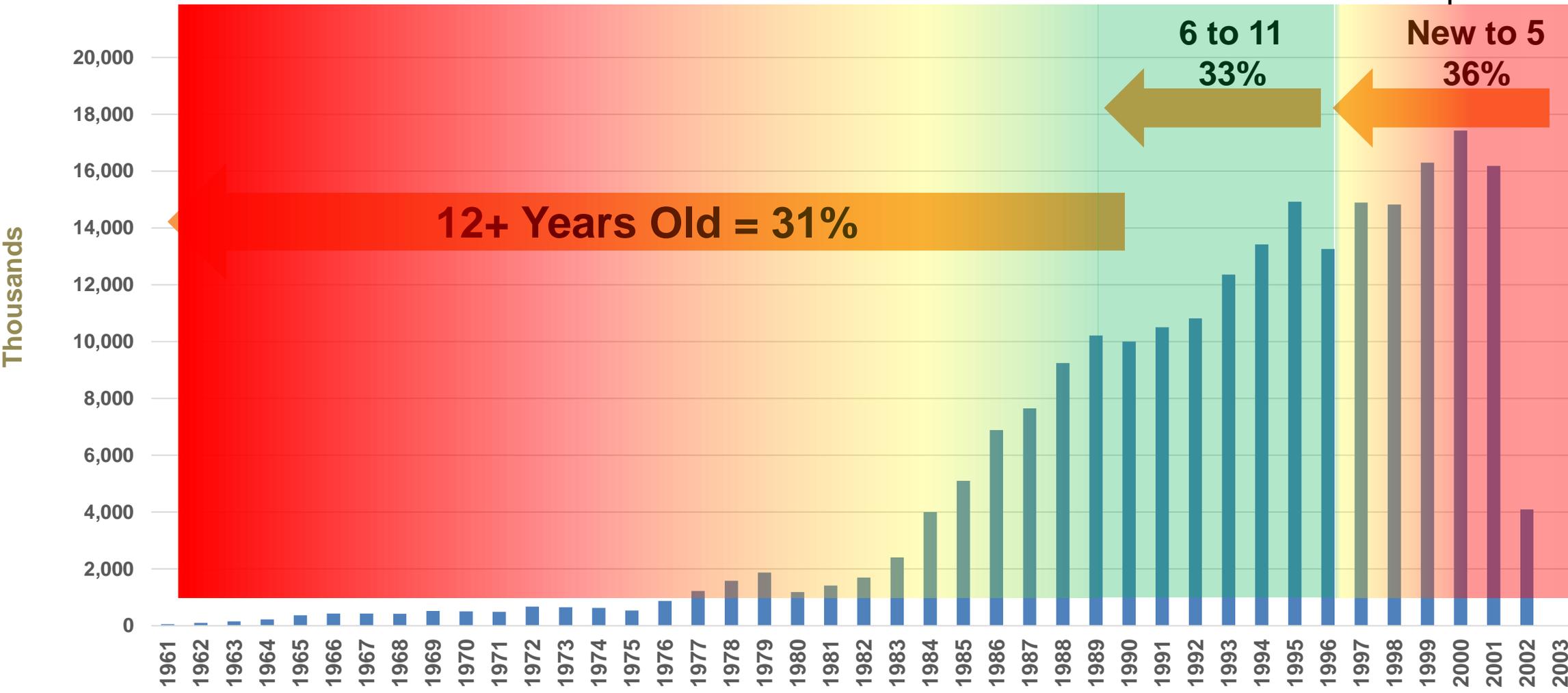
Forecast

Peak at 17.6M in 2016

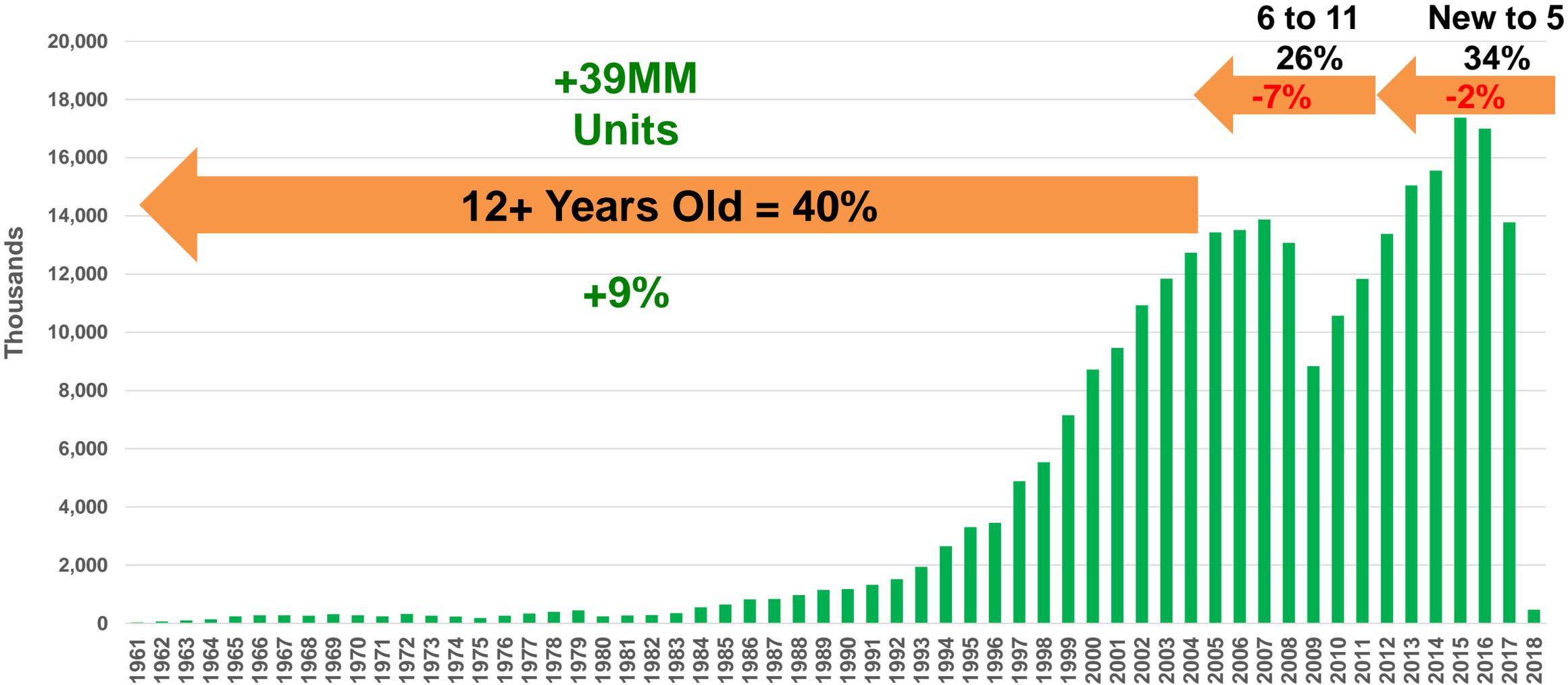
U.S. Light Vehicle Sales



2002: U.S Light Vehicle VIO by Model Year



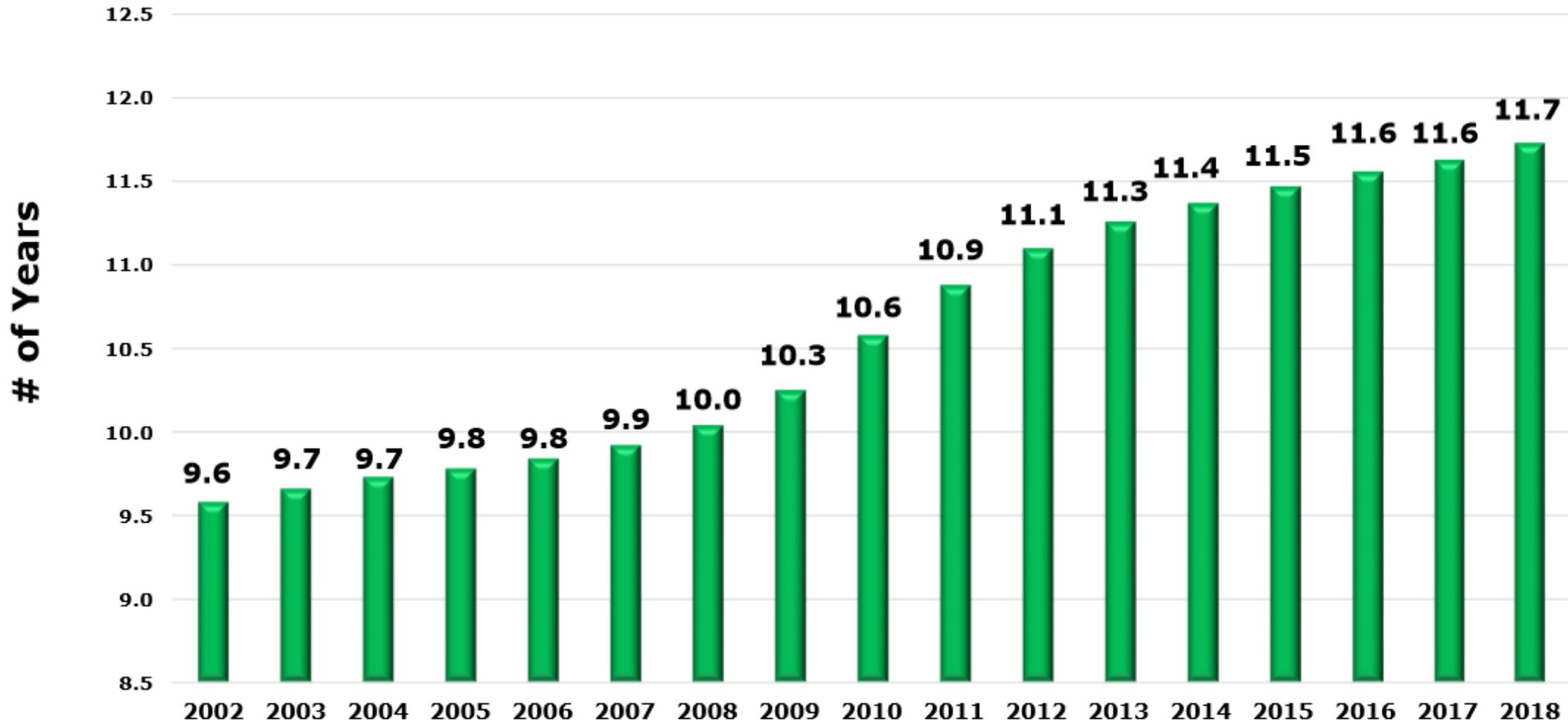
2017: U.S Light Vehicle VIO by Model Year



Total 2017 VIO = 271M



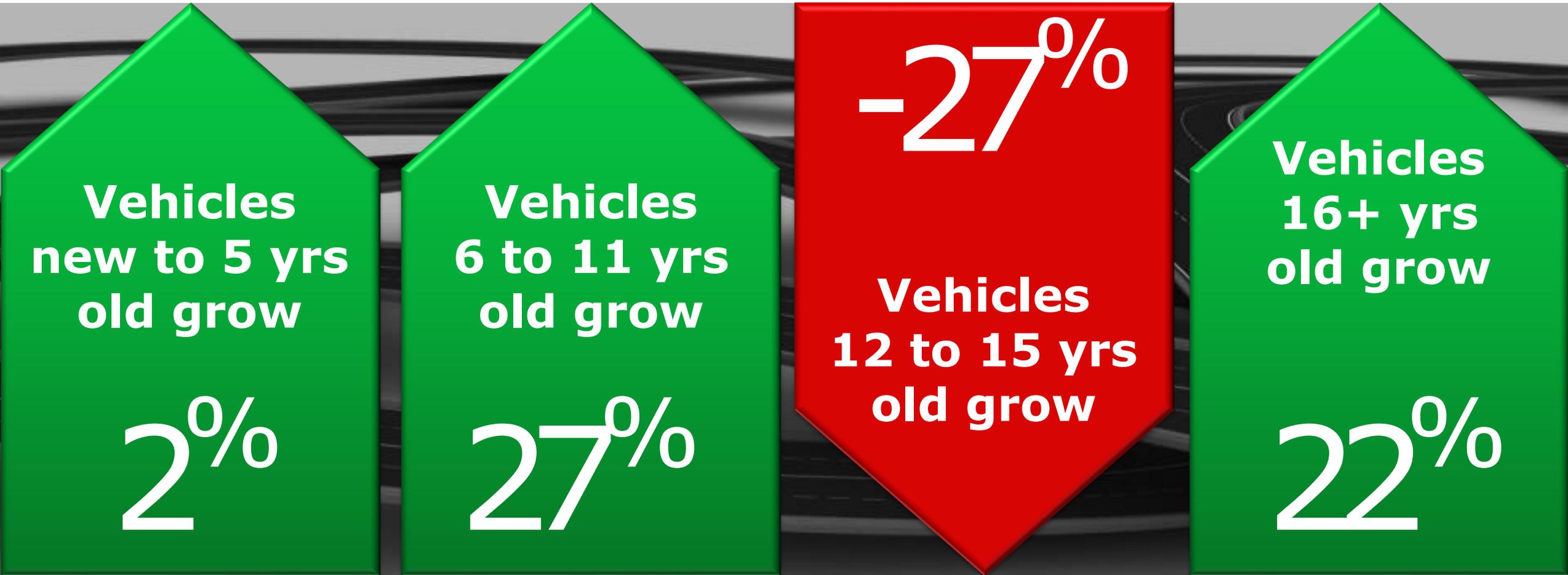
Average Age History: Cars & Lt Trucks



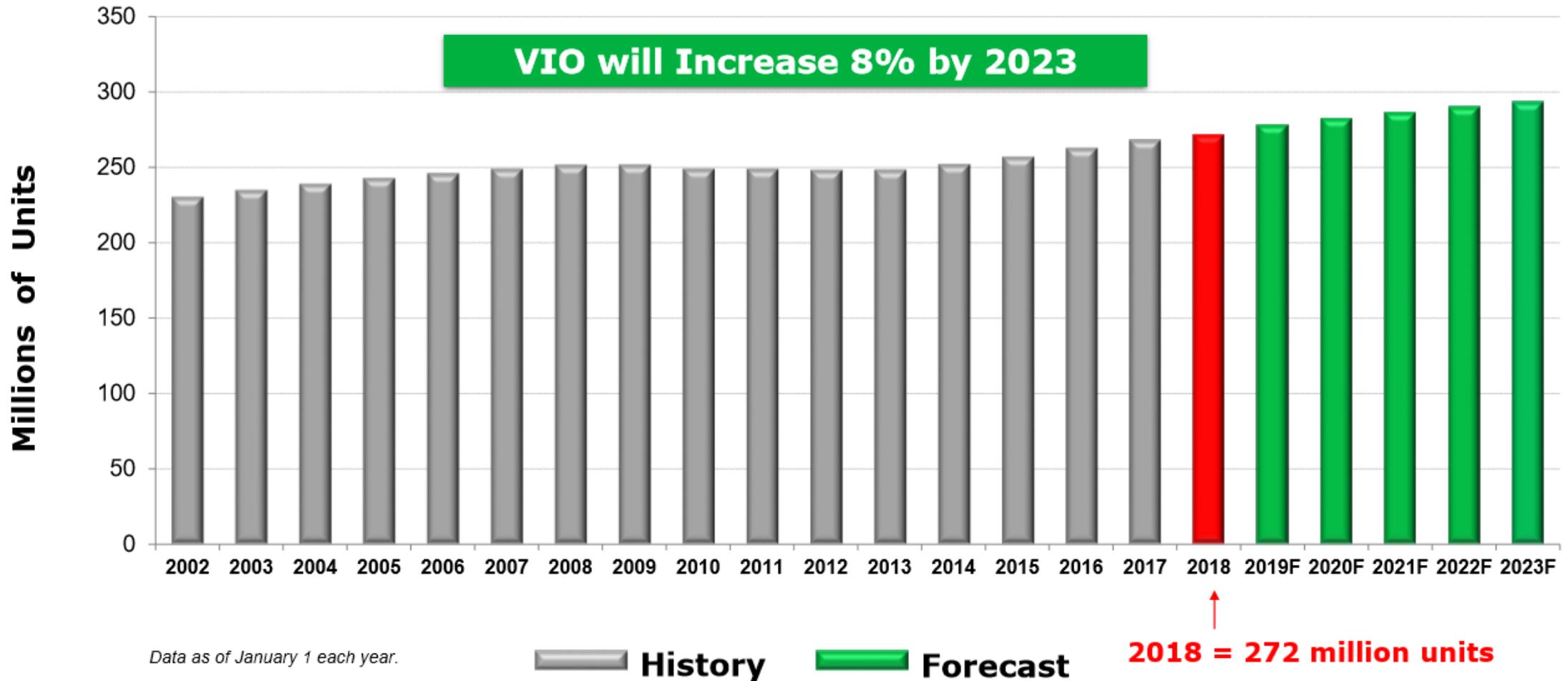
© 2018 IHS Markit. All Rights Reserved.

Source: IHS Markit

Impact on VIO Age Groups – 2018-2023



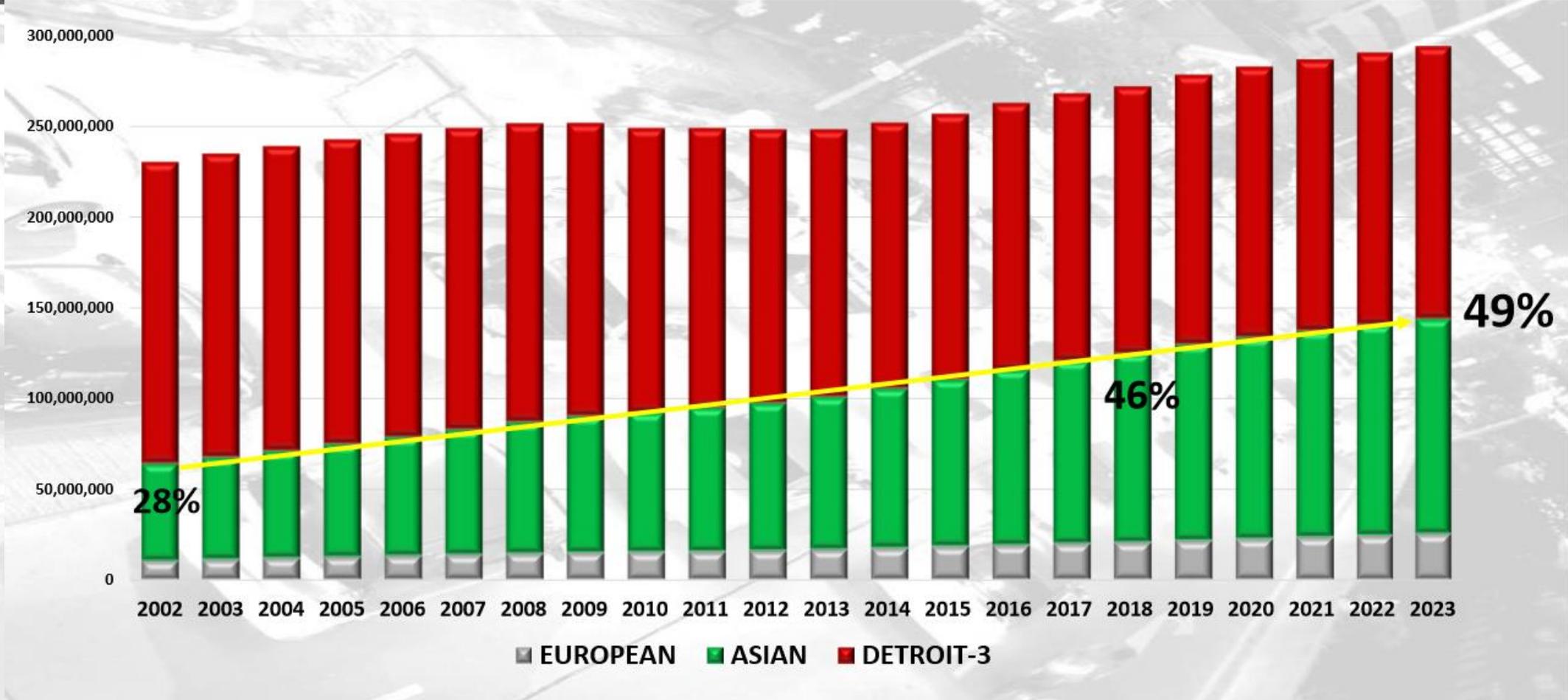
U.S. Light Vehicles in Operation



© 2018 IHS Markit. All Rights Reserved.

Source: IHS Markit – October 2018 Forecast

Change in Mix – Domestic vs Imports



© 2018 IHS Markit. All Rights Reserved.

Source: IHS Markit – 2018 Forecast

Cars per Bay

More Light Vehicles but Fewer Service Bays

There were over 8,000 fewer service bays in the U.S. at mid-year 2017 than five years earlier. This bay loss occurred despite a 10% increase in cars and light trucks on U.S. roads.

There were 228 cars and light trucks per bay in the U.S. during 2016 and a record-high 235 vehicles for each service bay by 2017.

Lang Marketing projects there will be a record-high number of cars and light trucks per bay by 2020, an increase of approximately 20% since 2012.

Cars per Bay

Aftermarket Challenge

Automotive technicians must continuously become more productive so that the shrinking number of service bays can handle the growing volume of car and light truck repairs across the U.S.

Aftermarket Opportunities

This provides significant opportunities for suppliers of diagnostic and installation equipment that can speed up vehicle repair as well as shop management, vehicle data programs and other means that can increase technician productivity.

EMERGING TECHNOLOGIES/TRENDS

Advanced Driver Assistance Systems

ADAS – New Opportunities

Adaptive Cruise Control (2000)

Back-up Cameras/Sensors (2002)

Adaptive Headlights (2003)

Lane Departure Warning (2004)

Automatic Parking (2006)

Blind Spot Monitoring (2007)

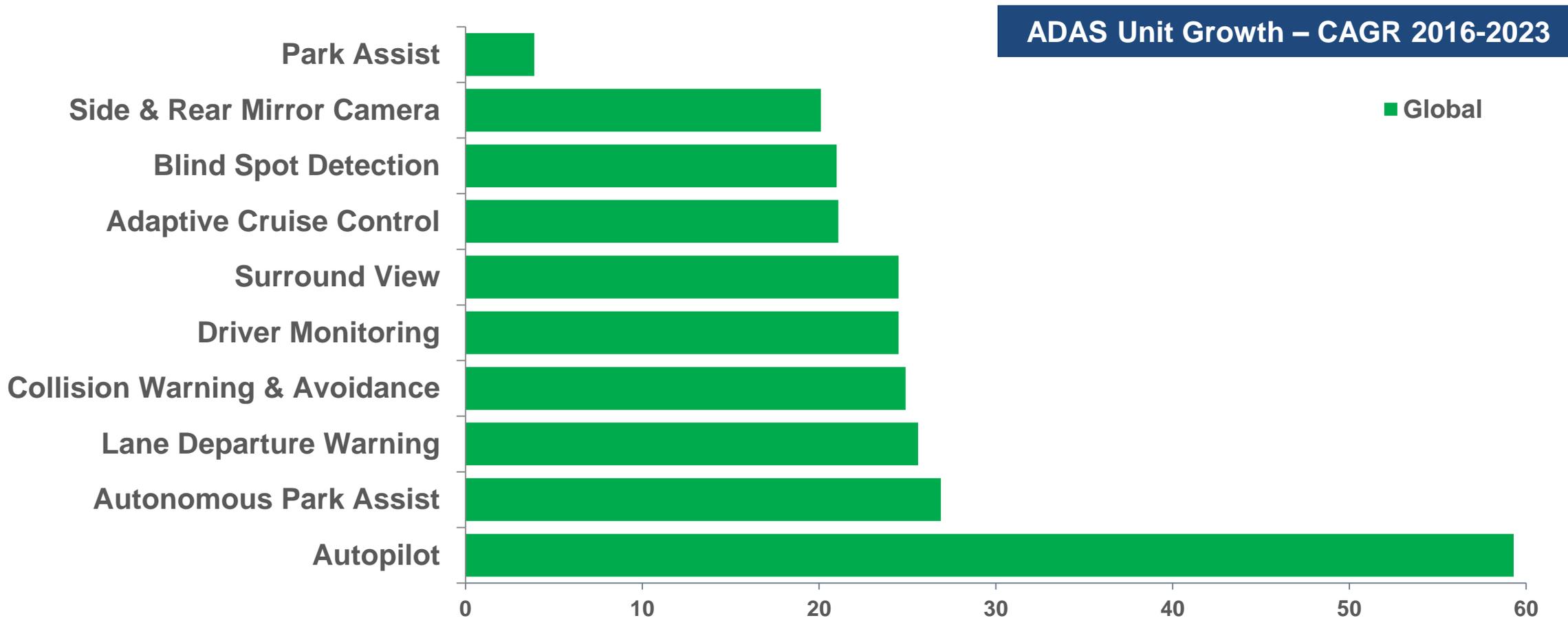
Emergency Braking (2010)

Pedestrian Detection (2013)

Drowsy Driver Detect (2015)

Night Vision (2016)

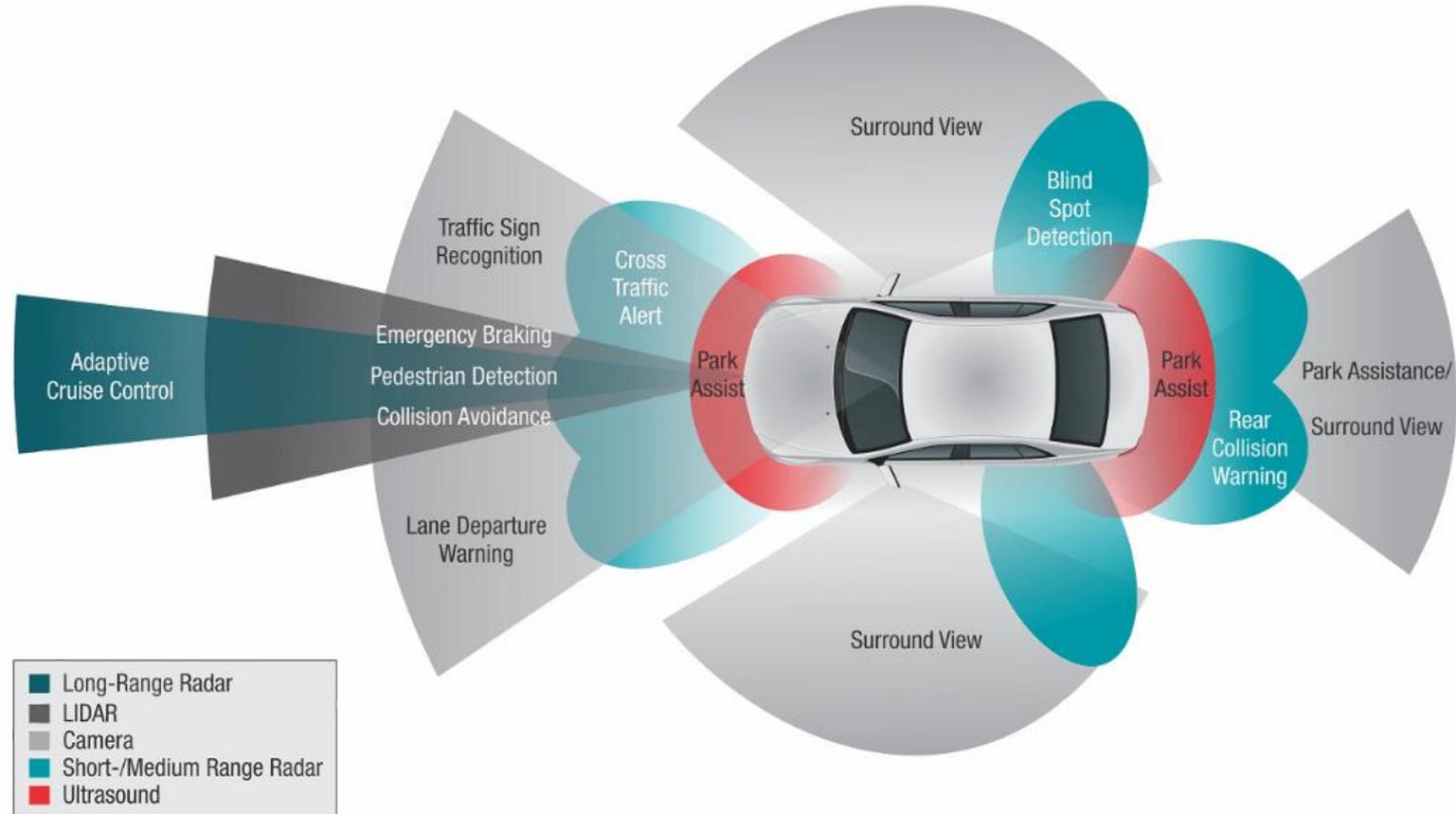
Advanced Driver Assist Systems Growing Rapidly



Full Driver Control → *Driver Assisted* → *Fully Autonomous Car*

Source: IHS Markit

ADAS = Vehicle Self-Awareness



The Original Self-Driving Vehicle



ADAS Systems enable an Autonomous Future

L5: Self-driving Only

L4: Full Self-driving

L3: Limited Self-driving

L2: Partial Autonomy

L1

Self-Driving Car Only

Self-Driving & Human-Driven Car

**Auto Pilot: Parking
Auto Pilot: Highway
SuperCruise**

**Park Assist
Adaptive Cruise Control
Lane Keep Assist**

**Autonomous Braking
Adaptive Cruise Control**

2010

2015

2020

2025

2030

Full Driver Control → Driver Assisted → Fully Autonomous Car

Sensors for Self-Driving

Cameras

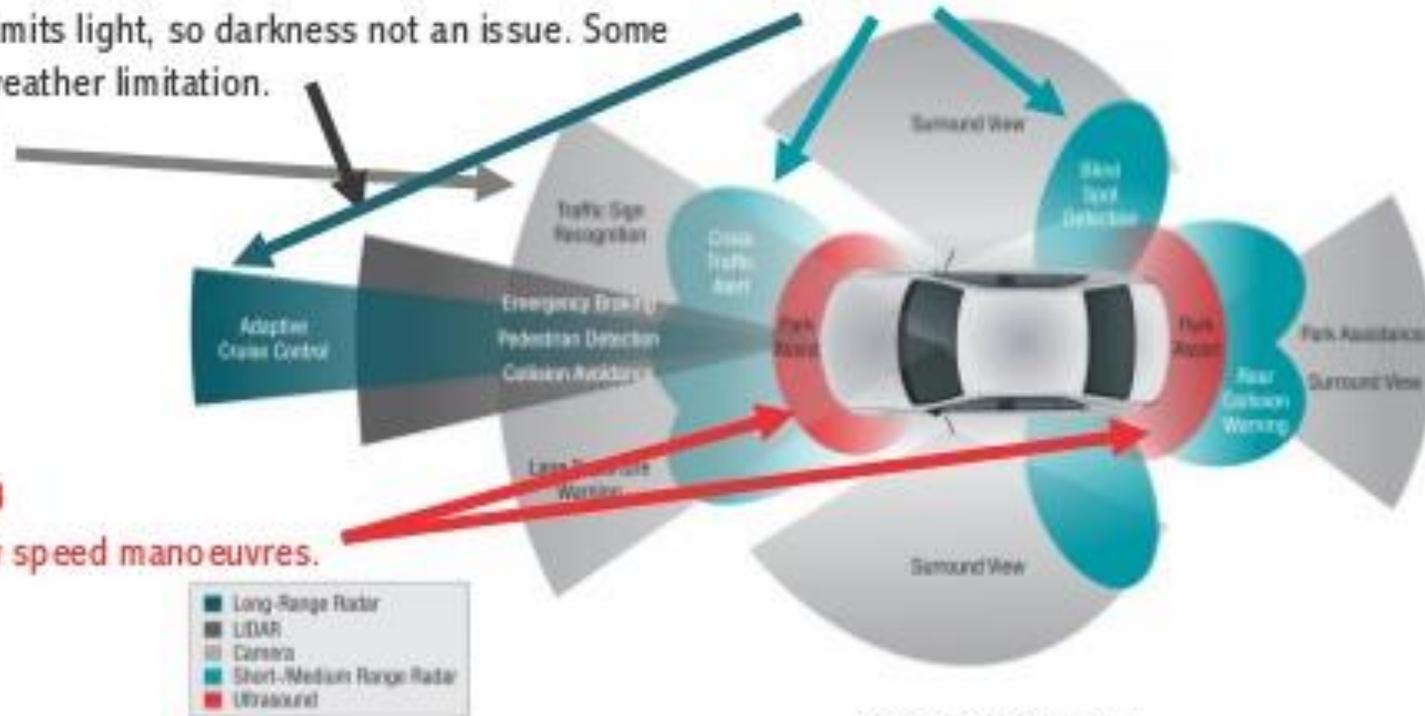
Senses reflected light, limited when dark. Sees colour, so can be used to read signs, signals, etc.

LIDAR

Emits light, so darkness not an issue. Some weather limitation.

Radar

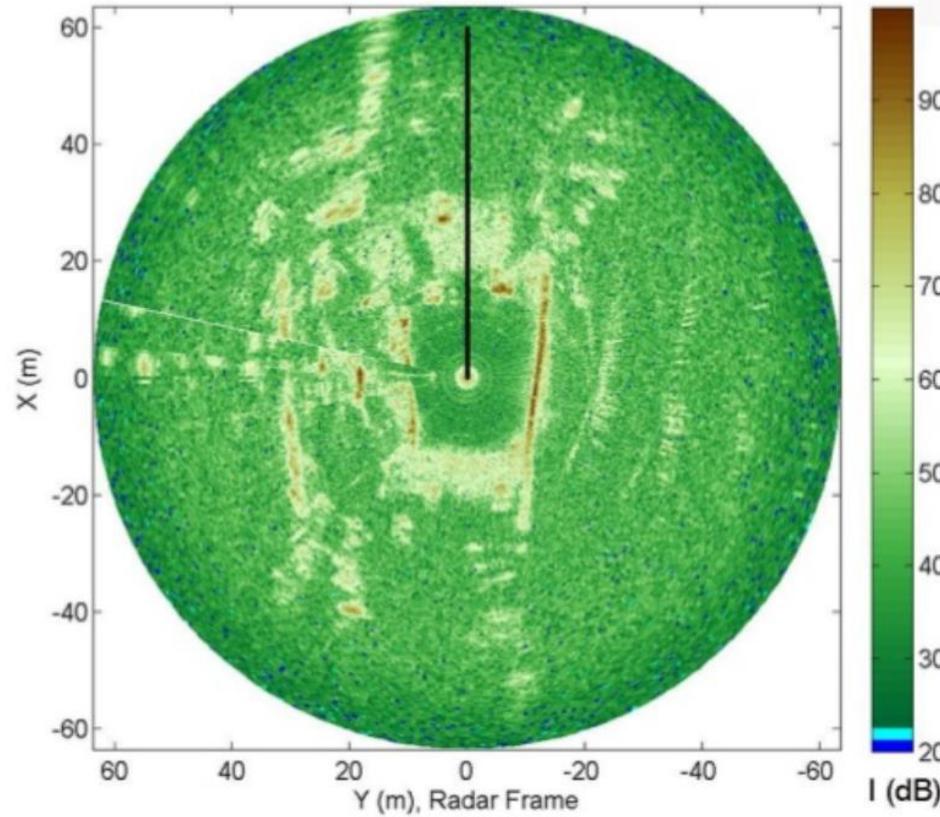
Works in low light & poor weather, but lower resolution.



Source: Texas Instruments

9

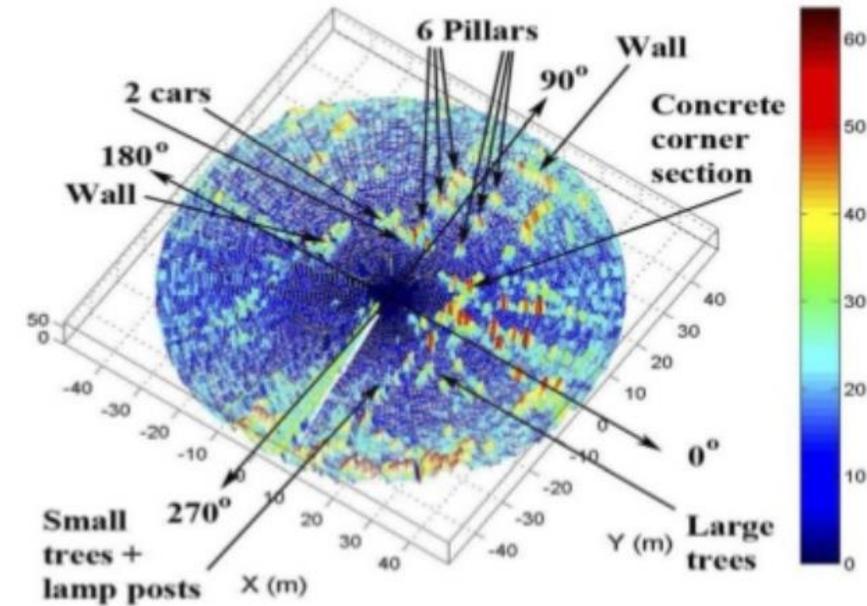
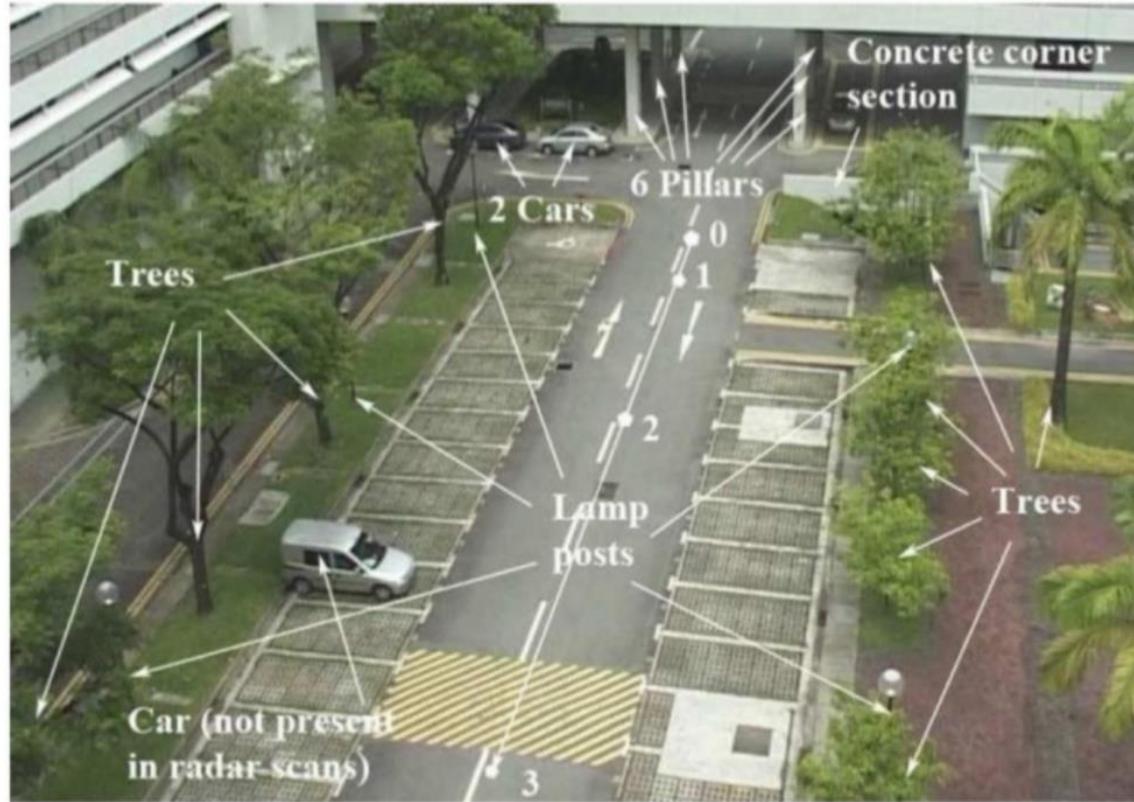
Radar Sensing for Intelligent Vehicles in Urban Environments



Radar image

Front camera view

Predicting Millimeter Wave Radar Spectra for Autonomous Navigation



360 radar scan from the initial vehicle location "0", showing the power received from range values up to 50 m.

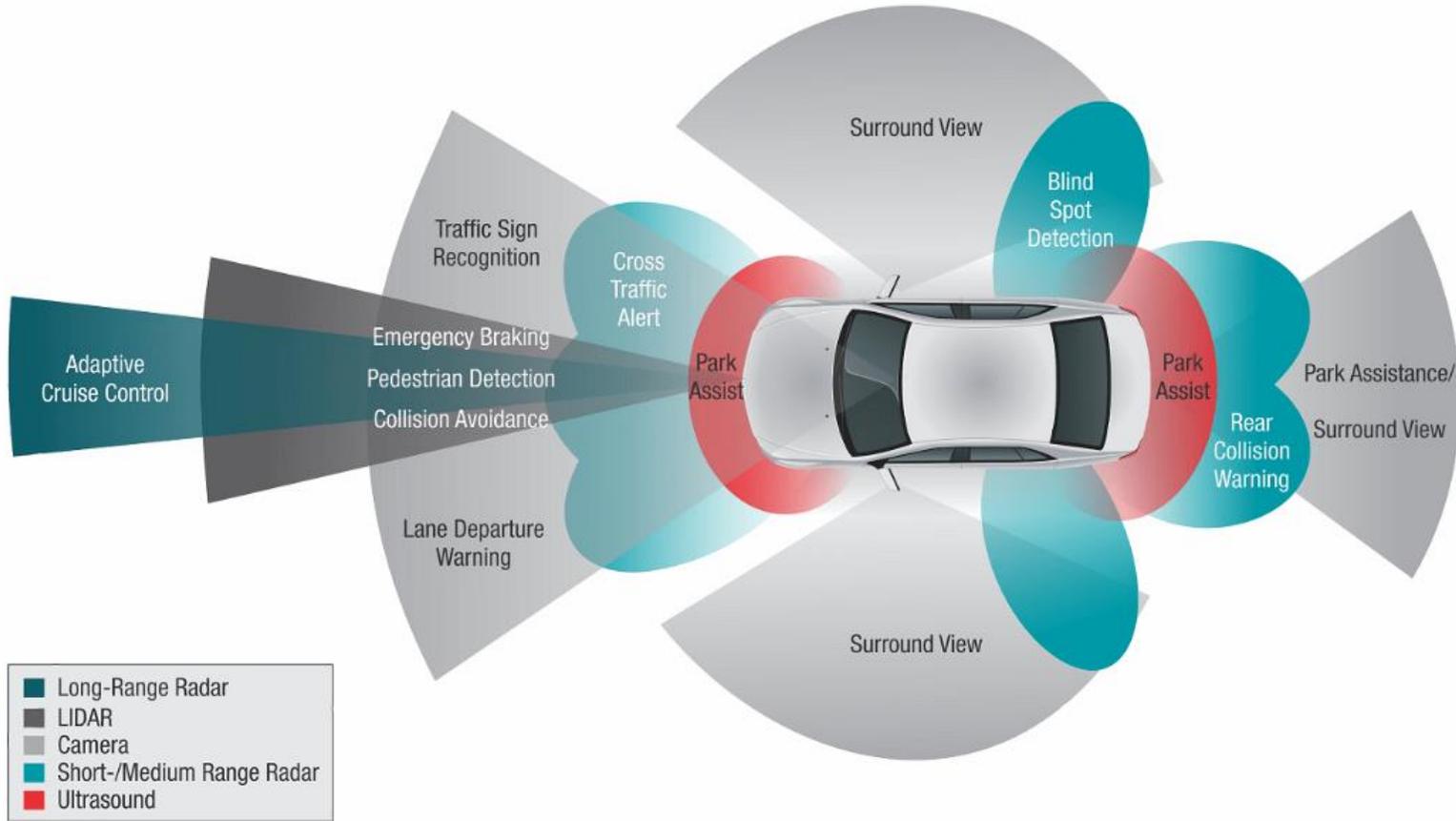
The car park environment used for comparing predicted and actual radar scans, with certain artifacts and natural objects labeled.

The Building Blocks of Autonomy

Prepared by  VISION SYSTEMS INTELLIGENCE



Copyright 2016 – Vision Systems Intelligence, LLC.



+ AI

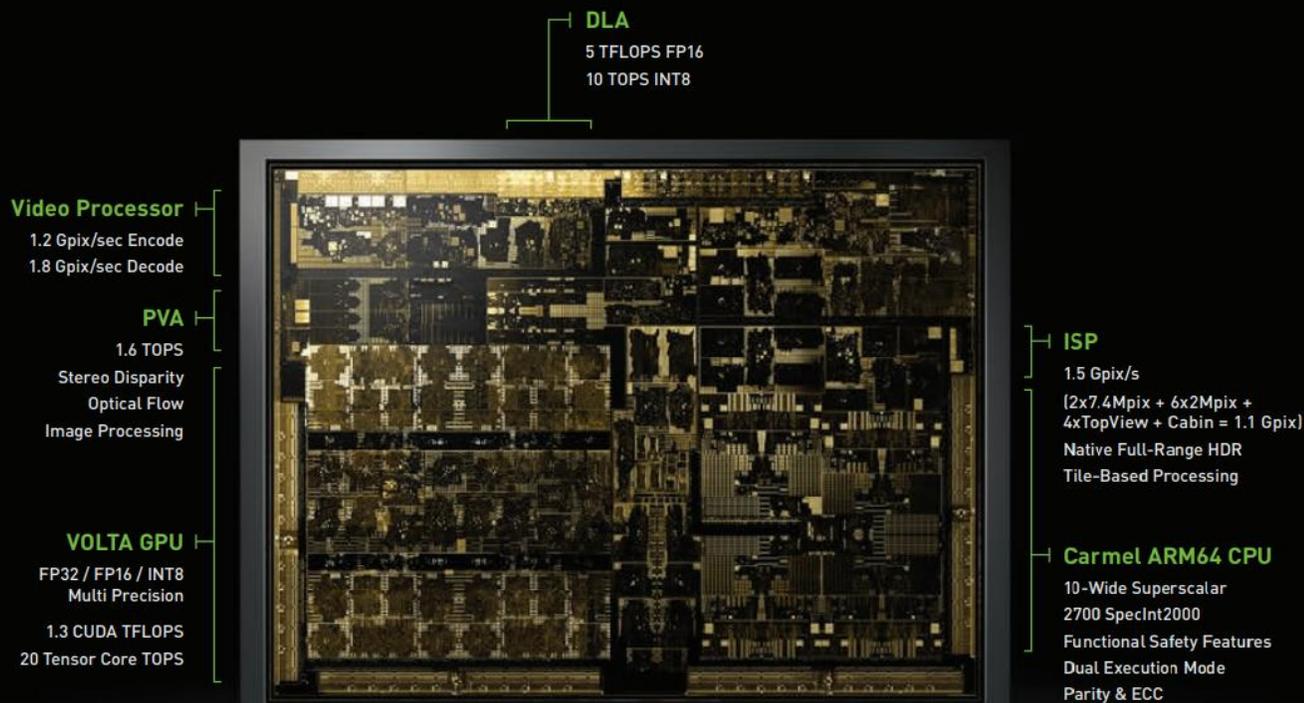
Nvidia, Bosch to make self-driving car computer with new Xavier chip

Bosch will use Nvidia's upcoming Drive PX board with the Xavier chip to develop self-driving car computers



NVIDIA DRIVE XAVIER

THE WORLD'S FIRST AUTONOMOUS MACHINE PROCESSOR



Other Barriers to AV L4-5

Data

Test AV's today generate 30 TB of data per day (each)

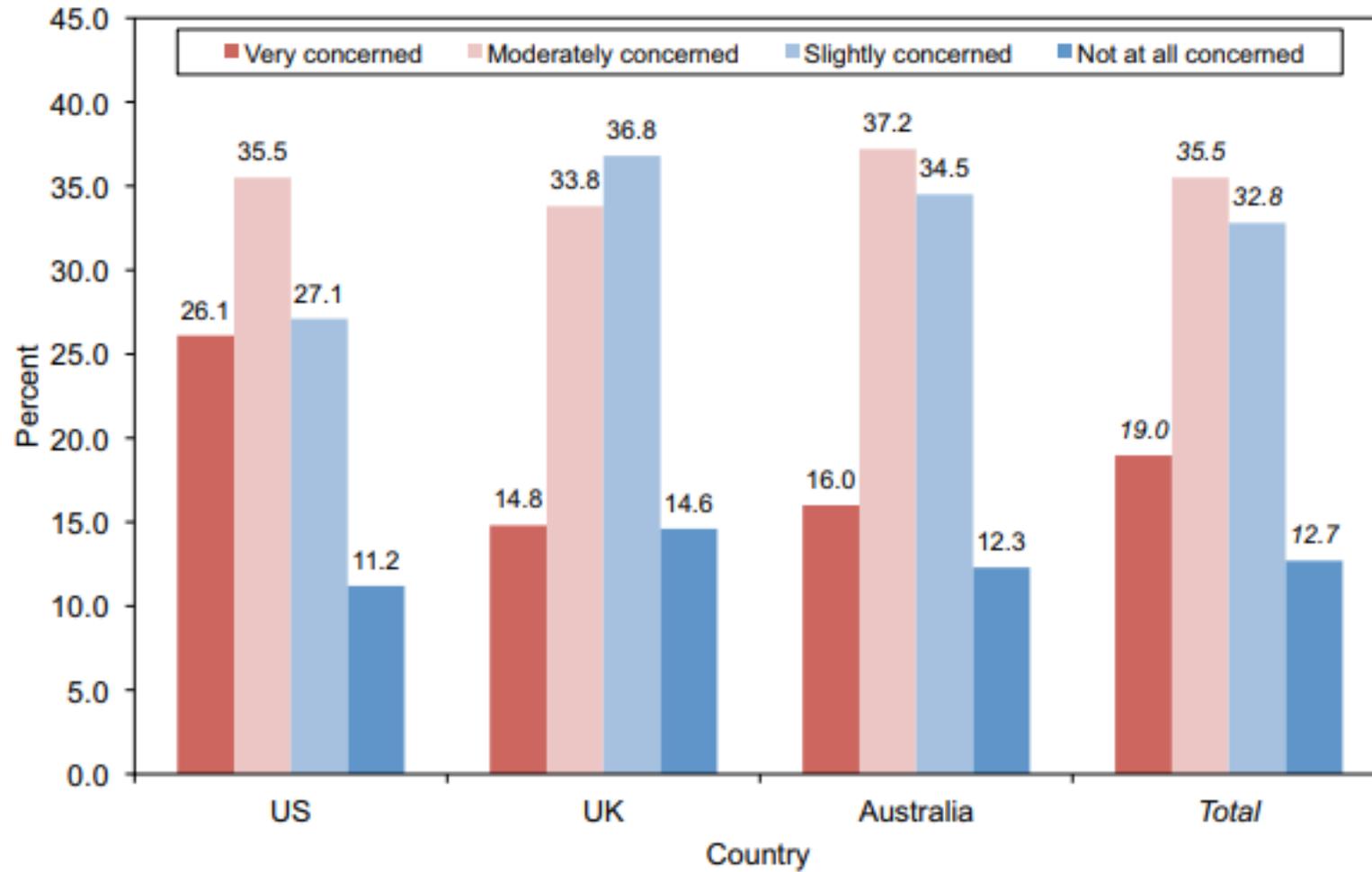
Twitter's 270 million users produce about 100 GB per day

Centralized storage and bandwidth usage are huge barriers

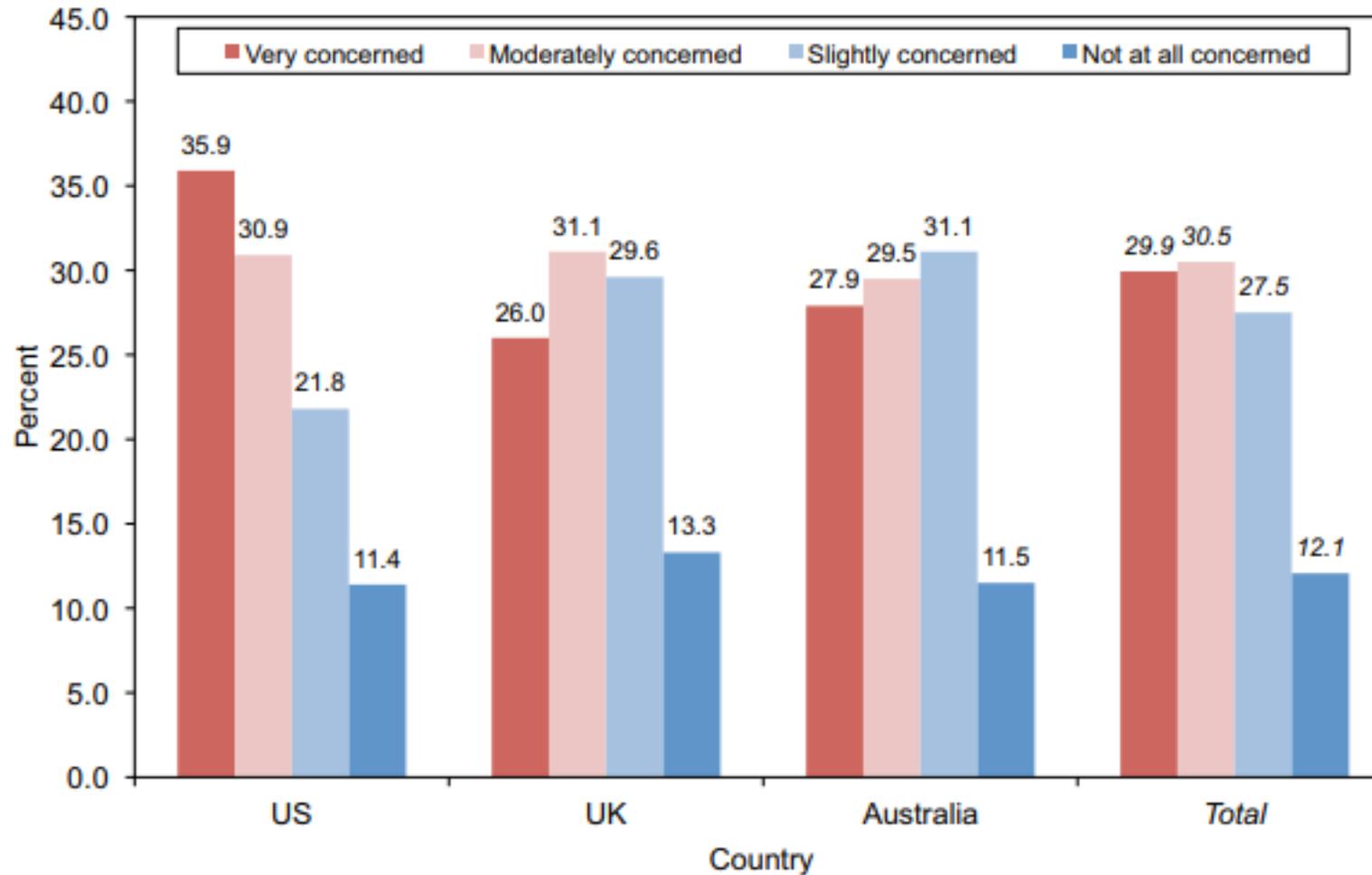
Other Barriers to AV L4-5

Customer Acceptance

“How concerned would you be about driving or riding in a vehicle with Level 3 self-driving technology?”



“How concerned would you be about driving or riding in a vehicle with Level 4 self-driving technology?”



Collisions Preventable by Forward Collision and Automatic Braking 2016

	Crashes	Injuries	Deaths
Total Rear-End and Pedestrian/Cyclist Crashes	2,484,000	1,111,000	6,933
Unlikely Preventable by FCW / AEB			
<i>Inclement Weather</i>	243,000	98,000	523
<i>Adverse Surface Conditions</i>	129,000	48,000	296
<i>Occurred off Road</i>	2,000	1,000	112
<i>Loss of Control</i>	50,000	33,000	373
<i>Driver Asleep/III/Impaired</i>	66,000	47,000	891
Total Unlikely Preventable by FCW / AEB	490,000	227,000	2,195
Potentially Preventable by FCW / AEB	1,994,000	884,000	4,738

	Crashes	Injuries	Deaths
	Number (Column %)		
Rear-End	1,687,000 (84.6)	739,000 (83.6)	987 (20.8)
Single Vehicle vs. Ped/bike	83,000 (4.2)	81,000 (9.2)	3,501 (73.9)
Turn Into/Across Path	109,000 (5.5)	32,000 (3.6)	45 (0.9)
Others	115,000 (5.8)	33,000 (3.7)	205 (4.3)
Total	1,994,000 (100.0)	884,000 (100.0)	4,738 (100.0)

Unintentional Lane Departure Crashes avoidable with Lane Departure and Lane Keeping Assist systems 2016

	Crashes	Injuries	Deaths
Total Unintentional Lane Departure Crashes	1,395,000	589,000	15,445
Unlikely Preventable by LDW /LKA			
<i>Inclement Weather</i>	295,000	108,000	1,717
<i>Adverse Surface Conditions</i>	135,000	51,000	1,096
<i>Loss of Traction/Control</i>	242,000	129,000	4,215
<i>Driver Asleep/III/Impaired</i>	203,000	114,000	3,763
<i>Total Unlikely Preventable by LDW / LKA</i>	876,000	402,000	10,791
Potentially Preventable by LDW / LKA	519,000	187,000	4,654

	Crashes	Injuries	Deaths
		Number (Column %)	
Road Departure	240,000 (46.2)	109,000 (58.3)	2,536 (54.5)
Sideswipe/Angle	103,000 (19.8)	25,000 (13.4)	406 (8.7)
Head-On	14,000 (2.7)	20,000 (10.7)	1,320 (28.4)
Others	162,000 (31.2)	33,000 (17.6)	392 (8.4)
Total	519,000 (100.0)	187,000 (100.0)	4,654 (100.0)

Autonomy uncertain – ADAS is here to stay!

L5: Self-driving Only

L4: Full Self-driving

L3: Limited Self-driving

L2: Partial Autonomy

L1

Self-Driving Car Only

Self-Driving & Human-Driven Car

**Auto Pilot: Parking
Auto Pilot: Highway
SuperCruise**

**Park Assist
Adaptive Cruise Control
Lane Keep Assist**

**Autonomous Braking
Adaptive Cruise Control**

2010

2015

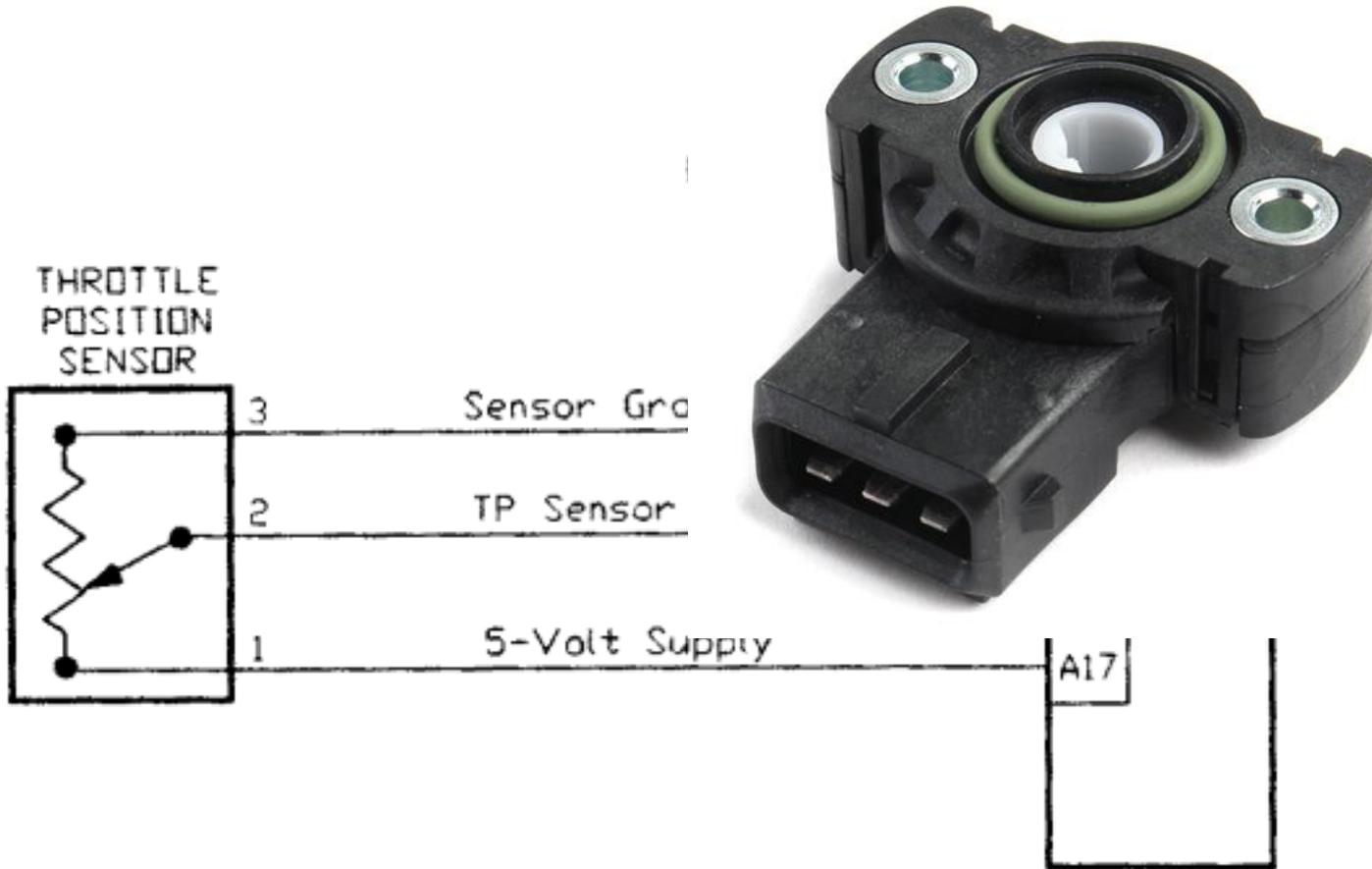
2020

2025

2030

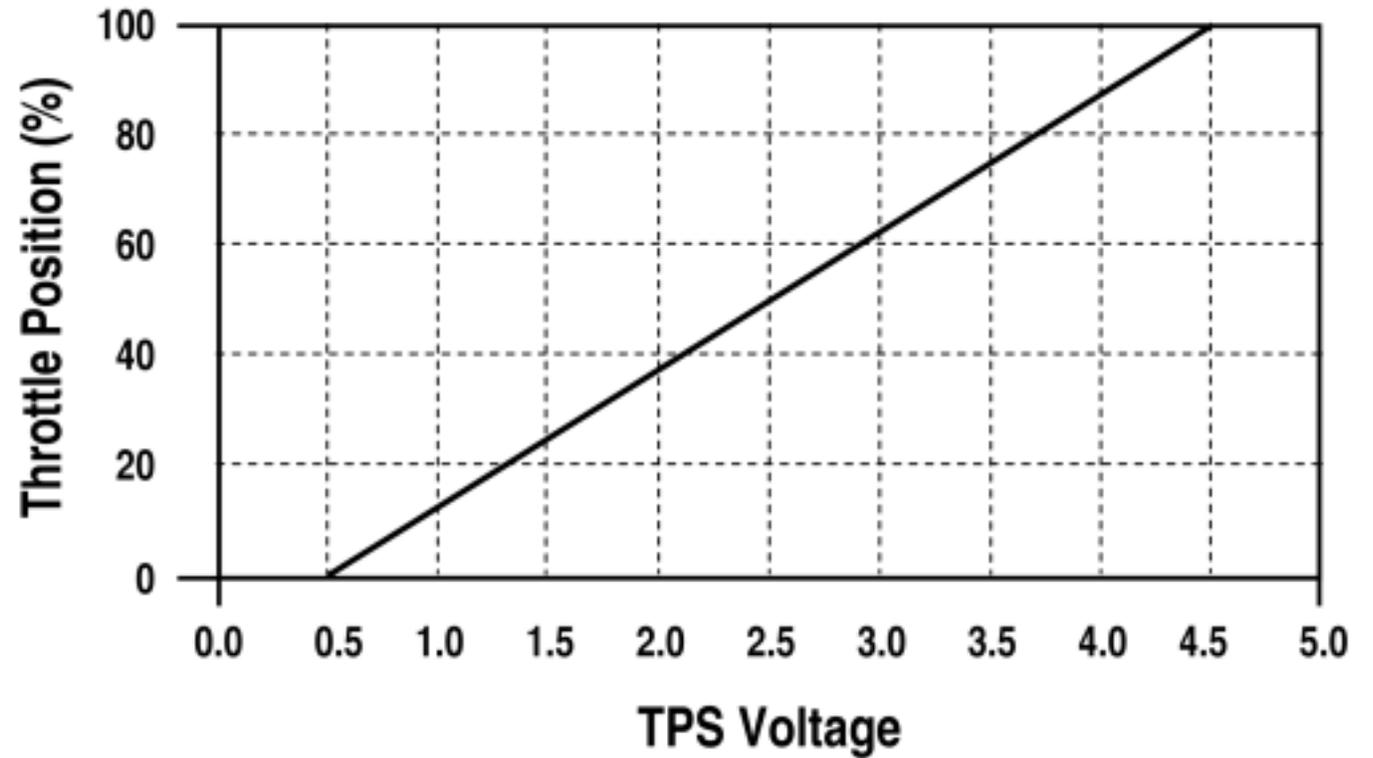
Full Driver Control → Driver Assisted → Fully Autonomous Car

Remember this?

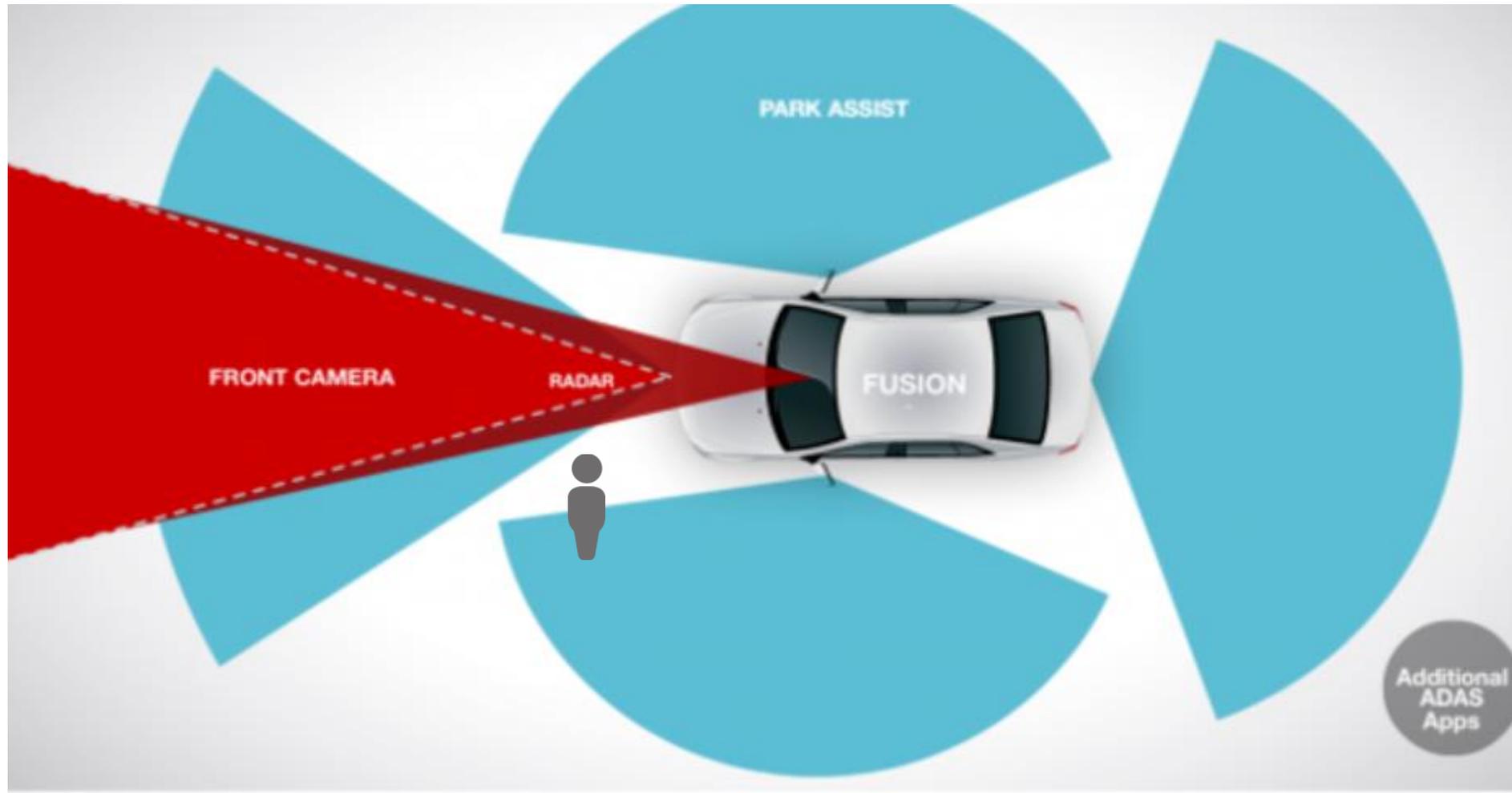


Throttle Position (% open)	Sensor Voltage
0	0.50
5	0.70
10	0.90
15	1.10
20	1.30
25	1.50
40	2.10
50	2.50
60	2.90
75	3.50
80	3.70
100	4.50

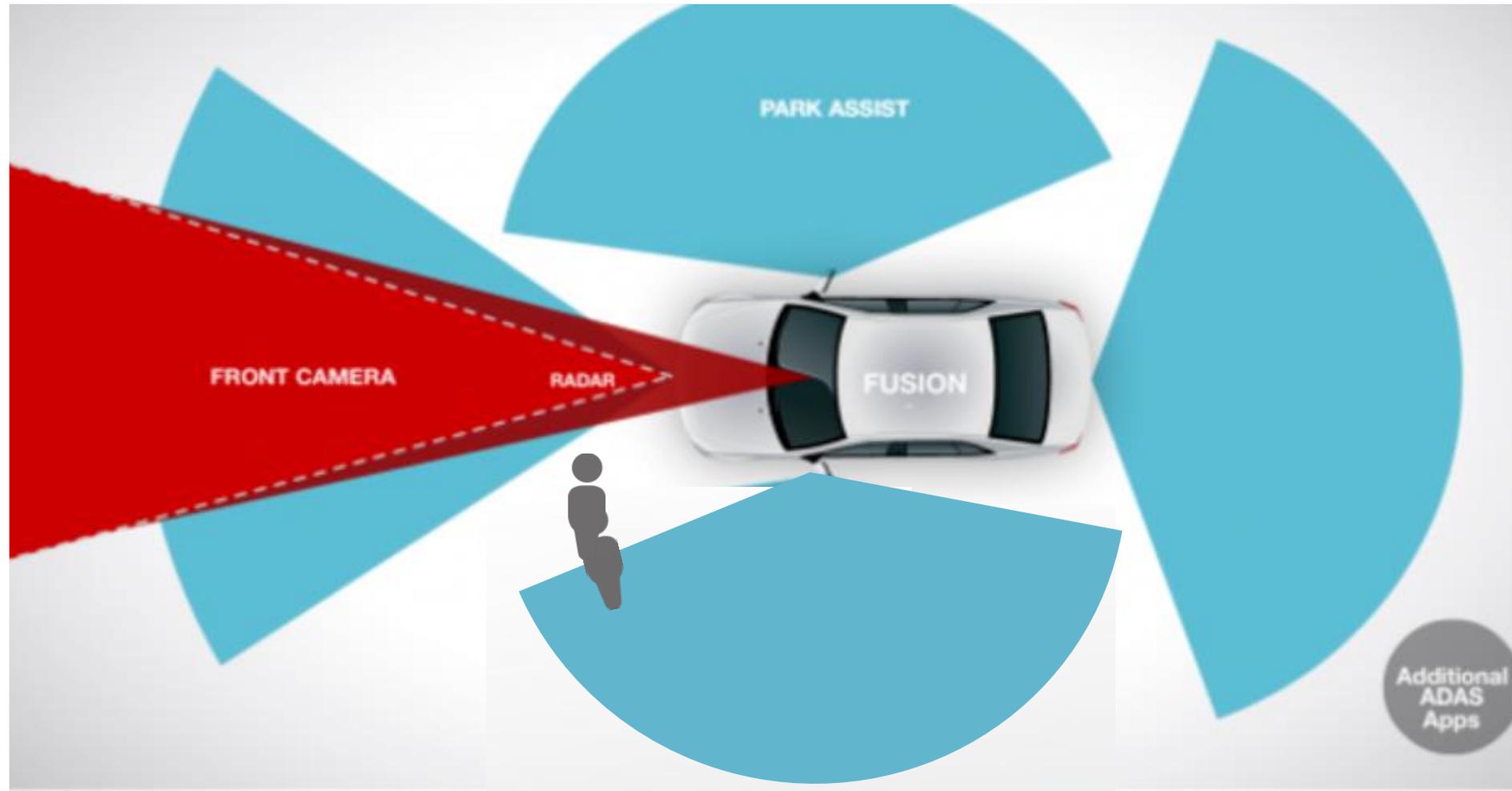
Throttle Position Sensor (TPS)



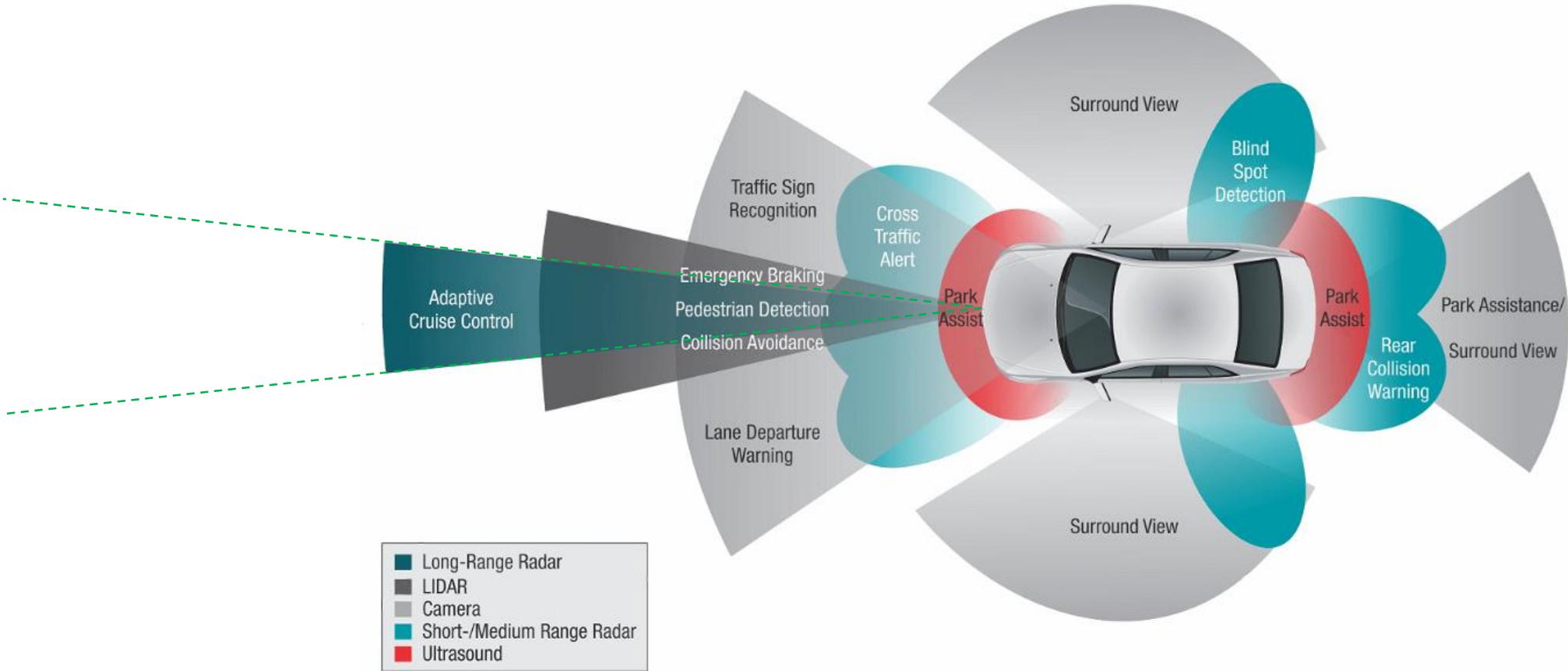
ADAS = Vehicle Self-Awareness



ADAS = Vehicle Self-Awareness



ADAS = Vehicle Self-Awareness



[Remove & Replace](#)[Air Conditioning Condensor](#) 1 of 2

Air Conditioning Condenser Replacement (LF3 With V03)

Removal Procedure

1. Recover the air conditioning system refrigerant. [Refrigerant Recovery and Recharging \(R-134a\)](#)[Refrigerant Recovery and Recharging \(R-1234yf\)](#)
2. Remove the air cleaner outlet duct. [Air Cleaner Outlet Duct Replacement](#)
3. Remove the air cleaner assembly. [Air Cleaner Assembly Replacement](#)
4. Remove the turbocharger wastegate actuator vacuum tank. [Turbocharger Wastegate Actuator Vacuum Tank Replacement \(LF3\)](#)
5. Remove the front bumper impact bar. [Front Bumper Impact Bar Replacement](#)
6. Remove the front bumper fascia center support. [Front Bumper Fascia Center Support Replacement \(Upper\)](#)[Front Bumper Fascia Center Support Replacement \(Lower\)](#)
7. Remove the forward range radar module, if equipped. [Forward Range Radar Module Replacement](#)
8. Reposition the electrical harness out of the way.
9. Place a drain pan under the transmission fluid cooler pipe and the transmission fluid cooler inlet and outlet pipe.

 **NOTE:** Cap the fittings and plug the holes when removing the transmission fluid cooler pipe and the transmission fluid cooler inlet and outlet pipe.

10. Disconnect the transmission fluid cooler pipe retaining ring (1) from the air conditioning condenser. [Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection](#)

 Fig 2: Transmission Fluid Cooler Pipe & Retaining Rings



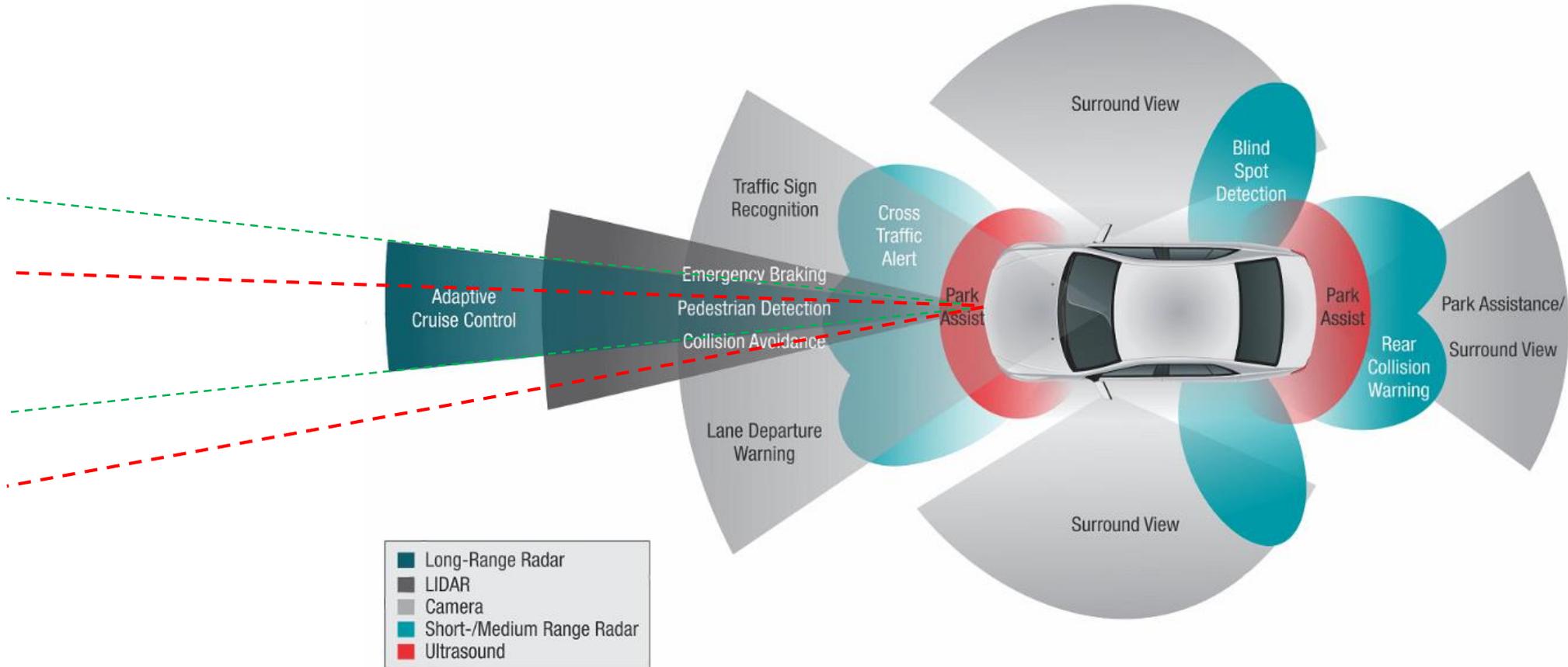
Courtesy of GENERAL MOTORS COMPANY

[View Full-Screen](#)

Callout	Component Name
<p>Preliminary Procedure Remove the front bumper fascia. Refer to Front Bumper Fascia Replacement (CTS)Front Bumper Fascia Replacement (CTS-V) .</p>	
<p>1</p>	<p>Forward Range Radar Module Bracket Fasteners (Qty: 3)</p> <div data-bbox="445 596 1719 716" style="background-color: #ffffcc; padding: 5px; margin: 5px 0;"> <p> CAUTION: Refer to Fastener Caution .</p> </div> <p>Tighten 9 N.m (80 lb in)</p>
<p>2</p>	<p>Forward Range Radar Module Bracket</p>
<p>3</p>	<p>Forward Range Radar Module Fasteners (Qty: 3)</p> <div data-bbox="445 978 1719 1098" style="background-color: #ffffcc; padding: 5px; margin: 5px 0;"> <p> CAUTION: Refer to Fastener Caution .</p> </div>
<p>4</p>	<p>Forward Range Radar Module Procedure</p> <ol style="list-style-type: none"> 1. Disconnect the electrical connector. 2. For programming and set up, refer to Control Module References .



ADAS = Vehicle Self-Awareness



Example - Front Facing Radar Sensors



Figure 3. This "see through" image shows how a radar sensor may be positioned behind a solid plastic cover in the grille. (Image: Mercedes-Benz)

Example – Ultrasonic Sensor



Figure 4. An ultrasonic sensor on the edge of a wheel well opening.
(Image: Wikipedia, Basotxerri, CC BY-SA 4.0)



Challenge: No Naming Standardization

OEM SYSTEMS	Ford	Toyota	Chevrolet	Nissan	Honda	Jeep	Hyundai	Kia	Subaru	GMC
Collision Warning Indicator	Forward Collision Warning System and Brake Support	Pre-Collision System (PCS)	Forward Collision Alert System	Predictive Forward Collision Warning (PFCW)	Collision Mitigation Braking System (CMBS)	Forward Collision Warning System	Forward Collision Warning System	Forward Collision Warning System	Pre-Collision Warning	Forward Collision Alert System
Automatic Emergency Braking	Active City Stop	Pedestrian Detection (PCS w/PD)	Low Speed Front Automatic Braking	Intelligent Forward Emergency Braking with Pedestrian Control	Forward Collision Warning (FCW)	Active Braking	Automatic Emergency Braking System with Pedestrian Detection	Autonomous Emergency Braking System with Pedestrian Detection	Pre-Collision Braking	Forward Automatic Braking/ Front Pedestrian Braking Braking
Lane Departure Alert	Lane Departure Warning	Lane Departure Alert	Lane Departure Warning	Lane Departure Warning (LDW)	Lane Departure Warning (LDW)	Lane Sense (Lane Departure Warning)	Lane Departure Warning	Lane Departure Warning System	Sway Warning	Lane Departure Warning
Lane Assist	Lane Keeping System	Steering Assist (LDA w/SA)	Lane Keep Assist	Lane Departure Prevention (LDP)	Lane Keep Assist System (LKAS)	Lane Sense (Lane Keep Assist)	Lane Keeping Assist System (LKAS)	Lane Keeping Assist System (LKAS)	Lane Keep Assist	Lane Keep Assist
Adaptive Cruise Control	Adaptive Cruise Control	Dynamic Radar Cruise Control and Full Speed Range Dynamic Cruise	Adaptive Cruise Control	Intelligent Cruise Control	Adaptive Cruise Control (ACC)	Adaptive Cruise Control	Smart Cruise Control with Start/Stop	Advanced Smart Cruise Control	Adaptive Cruise Control	Adaptive Cruise Control
Adaptive Headlights	Advanced Front Lighting System	Automatic High Beams (HBA)	IntelliBeam	Smart Auto Headlights	Auto High Beam Headlights	Automatic High beams	Dynamic Bending Light & Automatic High beam Assist	Dynamic Bending Light & Automatic High beam Assist	Steering Responsive Headlights /Fog lights and Automatic High beam Assist	IntelliBeam
Blind Spot Indicator	Blind Spot Information System (BLIS)	Blind Spot Monitor System	Side Blind Zone Alert Technology	Blind Spot Warning/Intervention (BSW,BSI)	Lane Watch System/ Lane Watch Camera	Blind Spot Monitoring	Blind Spot Detection with Lane Change Assist	Blind Spot Detection with Lane Change Assist	Blind Spot Detection with Lane Change Assist	Side Blind Zone Alert Technology with Lane Change Assist
Rear Cross Traffic	Cross Traffic Alert (CTA)	Rear Cross Traffic Alert (RCTA)	Rear Cross Traffic Alert	Rear Cross Traffic Alert	Rear Cross Traffic Monitor	Cross Path Detection	Rear Cross Traffic Alert (RCTA)	Rear Cross Traffic Alert (RCTA)	Rear Cross Traffic Alert	Rear Cross Traffic Alert
Automated Parking	Active Park Assist	Intelligent Park Assist (IPA)	Automatic Parking Assist	Intelligent Parking Assist	Smart Parking Assist System	Parallel and Perpendicular Park Assist	Smart Parking Assist System	Smart Parking Assist System	Not Available	Automatic Parking Assist

Challenge: Paying Attention

Do I need to calibrate? Do I need targets?

OEM ADAS SYSTEM CALIBRATION METHODS	MY 2015	MY 2016	MY 2017	MY 2018	MY 2015	MY 2016	MY 2017	MY 2018	MY 2015	MY 2016	MY 2017	MY 2018	MY 2015	MY 2016	MY 2017	MY 2018	MY 2015	MY 2016	MY 2017	MY 2018	MY 2015	MY 2016	MY 2017	MY 2018	
	Forward camera	Forward camera	Forward camera	Forward camera	Forward radar	Forward radar	Forward radar	Forward radar	Rear View camera	Rear View camera	Rear View camera	Rear View camera	360 view camera	360 view camera	360 view camera	360 view camera	Side radar	Side radar	Side radar	Side radar	Rear park aid	Rear park aid	Rear park aid	Rear park aid	
Acura	Static	Static	No calibration	No calibration	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	No calibration	No calibration	Initialization	Initialization							
Audi	Static	Static	Static	Static	Static	Static	Feature NA	Static	Static	Static	Static	Static	Static	Static	Static	Initialization	Initialization	Static	Static						
BMW	Dynamic	Dynamic	Initialization	Initialization	Initialization	Initialization	Initialization	Initialization	Initialization	Initialization		Initialization	Initialization	TBD		Initialization	Initialization	TBD							
Buick	Dynamic	Dynamic	Dynamic	Dynamic	Feature NA	Feature NA	Dynamic	Dynamic	No calibration	No calibration	Dynamic	Initialization	Feature NA	Feature NA	Feature NA	Feature NA	No calibration	No calibration	Dynamic	TBD	No calibration	No calibration	No calibration	TBD	
Cadillac	Dynamic	Dynamic	Static	Static	Static	Dynamic	Static	Static	Static	TBD	No calibration	No calibration	No calibration	Initialization	No calibration	No calibration	Initialization	Initialization							
Chevy / GMC	Dynamic	Dynamic	Static	Static	Static	Dynamic	Feature NA	Feature NA	Feature NA	Feature NA	No calibration	No calibration	No calibration	Initialization	No calibration	No calibration	No calibration	Initialization							
Chrysler	Dynamic	Dynamic	No calibration	No calibration	Initialization	Initialization	Feature NA	Feature NA	Feature NA	Feature NA		Initialization	Initialization	TBD	No calibration	No calibration	No calibration	TBD							
Ford	Dynamic	Dynamic	Dynamic	Dynamic	Initialization	Initialization	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	TBD	
Honda	Static	Static	No calibration	No calibration	No calibration	No calibration	Feature NA	Feature NA	Feature NA	Feature NA	Static	Static	Static	Static	No calibration	No calibration	No calibration	No calibration							
Hyundai	Static	Static	Static	Static	Feature NA	Static	Static	Static	No calibration	No calibration	Initialization	Initialization	Feature NA	Feature NA	Static	Static	Static	Initialization	Initialization	Initialization	Initialization	No calibration	Initialization	Initialization	
Infiniti	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	No calibration	No calibration	No calibration	No calibration		Initialization	Initialization	Initialization							
Jeep	Dynamic	Dynamic	Dynamic	Dynamic	Initialization	Initialization	Initialization	Dynamic	No calibration	No calibration	Initialization	Initialization	Feature NA	Feature NA	Feature NA	Feature NA	No calibration	No calibration	Dynamic	Dynamic	Initialization	Initialization	Initialization	Initialization	
Kia	Static	Static	Static	Static	Feature NA	Static	Static	Static	No calibration	No calibration	No calibration	No calibration	Feature NA	Static	Static	TBD	Static	Initialization	Initialization	Initialization	No calibration	No calibration	Initialization	Initialization	
Lexus	Static	Static	Static	Static	Static	Static	Feature NA	Feature NA	Initialization	TBD	Static	Static	Static	TBD	Static	Static	Static	TBD							
Lincoln	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic	Static	Dynamic	Dynamic	Static	Static	Static	Static	Static	Static	Static	Static	Initialization	Initialization	Dynamic	Dynamic	Initialization	Static	Static	Initialization	
Mazda	Static	Static	No calibration	No calibration	No calibration	No calibration	Feature NA	Feature NA	Feature NA	Feature NA	Static	Static	Static	TBD	No calibration	No calibration	Static	TBD							
Mercedes	Static	TBD	Static	Static	Static	Static	TBD	Static	Static	Static	Static	Static	Static	TBD	Initialization	Dynamic	Dynamic	TBD							
Mitsubishi	Initialization	Dynamic	Static	Static	Dynamic	Dynamic	Dynamic	TBD	No calibration	No calibration	No calibration	No calibration	Feature NA	Static	Static	Static	Feature NA	Static	Static	TBD	Feature NA	No calibration	Static	TBD	
Nissan	Static	Static	Initialization	Initialization	Static	Static	Feature NA	Feature NA	Initialization	TBD	No calibration	No calibration	No calibration	TBD	Initialization	Initialization	Initialization	TBD							
Subaru	Static	Static	No calibration	No calibration	No calibration	No calibration	Feature NA	Feature NA	Feature NA	Feature NA	Static	Static	Static	TBD	Feature NA	Static	Static	TBD							
Toyota	Static	Static	Static	Static	Static	Static	Feature NA	Feature NA	Feature NA	Static	Static	Static	Static	Static	Static	Static	Static	Static							
VW	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static	Static							

KEY

Static – Calibrate with targets and scan tool, vehicle stationary

Dynamic – Calibrate with scan tool and drive vehicle

Initialization – Basic operation parameters in new control module

No calibration – None required

Feature NA – Feature not available

Introducing ProDemand ADAS Quick Reference!

PRODEMAND CHANGE VEHICLE 2015 Cadillac SRX 3.6L Eng Premium RECALLS/CAMPAIGNS Contact Us Settings Logout

1SEARCH™ PLUS Search Enter Codes, Components or Symptoms Tuscany Demo 01

Technical Bulletins
Common Specs
Driver Assist ADAS
Fluid Capacities
TPMS
Tire Fitment
Reset Procedures
DTC Index
Wiring Diagrams
Component Locations
Component Tests
Service Manual

Based on Analysis of 4,507 Repairs

Commonly Replaced COMPONENTS	Common DTCs	Common SYMPTOMS	Top Search LOOKUPS
1. Battery 835	1. P0496: EVAP Flow Du... 44	1. Engine Does Not Start 139	1. Cabin Air Filter
2. Disc Brake Pad 765	2. P0014: B Camshaft Po... 8	2. Noise Heard From Bra... 51	2. P0496
3. Brake Rotor 571	3. P0442: EVAP System ... 7	3. Noise Heard When Dri... 39	3. Oil Life
4. Cabin Air Filter 406	4. P062f: Internal Control... 7	4. Air Conditioning Inope... 38	4. Common Specs & Pro...
5. Wheel Hub Assembly 353	5. P0174: System Too Le... 6	5. Noise Heard 35	5. Ecm
6. Tires 219	6. P0024: B Camshaft Po... 5	6. Noise Heard From Front 30	6. Hvac Control Module
7. Air Conditioning Refrig... 181	7. P0171: System Too Le... 5	7. Fluid Leaks From Vehi... 16	7. Side Object Sensor
8. Wheels 167	8. P0455: Evaporative E... 5	8. Noise Heard From Rear 16	8. Parking Sensor Syste...
9. Evap Purge Solenoid V... 143	9. C0045: Brake Pressur... 4	9. Brakes Vibrate When ... 15	9. Firing Order
10. Hvac Temperature Ble... 123	10. P0036: HO2S Heater ... 4	10. Engine Stalls 14	10. Engine Oil - Resetting

Driver Assist ADAS



Features

All Features

Adaptive Cruise Control System

Adaptive Headlight System

Automated Parking System

Blind Spot/Rear Cross Traffic Systems

Lane Assist System

Lane Departure Alert System

Components	Jobs Requiring Calibration	Special Tools (e.g., Calibration Targets) Required?	Scan Tool Needed?
blind spot monitoring indicator	-	-	-
cruise control systems	-	-	-
exterior light control modules	-	-	-
exterior light switch	-	-	-
exterior lighting	-	-	-
forward looking radar module	perform wheel alignment	-	-
headlight	-	-	-
lane departure switch	-	-	-
lane departure warning actuator	-	-	-
lane recognition systems	-	-	-
lighting sensor	-	-	-
multifunction switch	-	-	-
object detection alarm module	-	-	-
object detection sensor	-	-	-
outside view camera	calibrate outside view camera	-	Y
	perform wheel alignment		
	replace outside view camera		

← Driver Assist ADAS

Print



Features

All Features

Adaptive Cruise Control System

Adaptive Headlight System

Automated Parking System

Blind Spot/Rear Cross Traffic Systems

Lane Assist System

Lane Departure Alert System

Components	Jobs Requiring Calibration	Special Tools (e.g., Calibration Targets) Required?	Scan Tool Needed?
object detection alarm module	-	-	-
object detection sensor	-	-	-
outside view camera	calibrate outside view camera	-	Y
	perform wheel alignment		
	replace outside view camera		
park assist sensor	replace park assist sensor	-	Y
park assist switch/button	-	-	-
parking aid module	-	-	-
parking aid systems	-	-	-
power steering pump	-	-	-
steering control module	-	-	-

Technical Bulletins



TSBs Recalls and Campaigns related to your search

OEM Info

Specifications



OEM specifications

OEM Info

OEM Testing



OEM test procedures

OEM Info

Component Connector



Connector views and pin-outs

OEM Info

Component Location



Component location diagrams

OEM Info

Component Operation



Component operation and description

OEM Info

Wiring Diagrams



OEM and interactive wiring diagrams

Remove & Replace



OEM R&R procedures

After Repair Info



Post repair testing and validation

← After Repair Info

Print



☰ Outside View Camera 1 of 5



Front View Camera Module Calibration



Calibration (Without UGN)



 **NOTE:** Do NOT swap cameras between vehicles, it is not approved and a VIN mismatch will occur.

The calibration process for the front view camera system is necessary when a front view camera module is replaced by a new one. This process shall not be required when only replacing the windshield and the front view camera module has been mounted again properly. This process shall be completed within 3-5 minutes when the correct driving conditions are met. If conditions are not met correct, the front view camera module shall continuously run the service point calibration until successfully completed. This process shall work across ignition cycles and shall not be required to be re-initialized at start up. If the Lane Departure Warning Switch is pressed during calibration, the indicator will flash momentarily and then stay out - this is normal operation.

The calibration procedure will start automatically after SPS programming is complete. During this time the Lane Departure Warning amber indicator will illuminate.

To calibrate the front camera, operate the vehicle in the following conditions until the calibration is complete:

- Clean windshield.
- Avoid lane changes.
- Maintain vehicle speeds between 56-90 km/h (35-56 MPH).
- Ensure the road contains visible references (well defined lane markings, curbs, etc.).

Once the procedure is complete, the amber indicator will turn off. Shortly after the green ready to assist light should turn on as long as all conditions are met for normal operation. The system is then ready to assist.

Calibration (With UGN)



 **NOTE:** Do NOT swap cameras between vehicles, it is not approved and a VIN mismatch will occur.



Technical Bulletins



TSBs Recalls and Campaigns related to your search

OEM Info

Specifications



OEM specifications

OEM Info

OEM Testing



OEM test procedures

OEM Info

Component Connector



Connector views and pin-outs

OEM Info

Component Location



Component location diagrams

OEM Info

Component Operation



Component operation and description

OEM Info

Wiring Diagrams



OEM and interactive wiring diagrams

Remove & Replace



OEM R&R procedures

After Repair Info



Post repair testing and validation

Techni... > Collision/Avoidance

Print



Accessories Control Systems (3)

Collision/Avoidance (5)

OEM Ref #	Title	Pub Date
17-NA-375	DIAGNOSTIC TIPS FOR REAR VISION CAMERA IMAGE THAT IS GRAINY, DISTORTED AND/OR PIXELATED	2017-11-22
16-NA-107	DTC U0184 SET, RADIO INOPERATIVE, BLUE SCREEN, AM CLIPPING NOISE, HD ON/OFF STATUS NOT RETAINED IN STATIONS, TIME LAG ON TRANSITIONS, NO AUDIO WITH INTERNAL AMP, PARK ASSIST SYMBOL POSITION WRONG IN REAR VIEW CAMERA	2016-04-07
PI1187C	INFORMATION ON INSIDE REAR VIEW MIRROR AND CAMERA LOOSE	2015-12-01
PI1375C	BLANK DISPLAY, NAV SCREEN AUDIO CONTENT IS UNAVAILABLE VIA SPEECH RECOGNITION, DISPLAY SCREEN IS STUCK ON INCOMING CALL VIEW AFTER PHONE CALL FINISHED, REAR VIEW CAMERA DISPLAY BLANK, USB ISSUES/BLUETOOTH/FAVORITE BAR/VOICE, IPOD UNABLE TO DETECT VIA USB, RECOGNITION CONCERNS, XM SPEECH RECOGNITION INOPERATIVE, TRAFFIC MESSAGES, CLOCK DISPLAY	2015-04-17
PIT5366	DIAGNOSTIC TIP - REAR CAMERA AND/OR RADIO INOPERATIVE WITH POSSIBLE DTC B127B SYM2B	2015-02-03

Communication Devices (2)

Entertainment Systems (3)

Mirrors (1)

Navigation System (3)

Technical Bulletins



TSBs Recalls and Campaigns related to your search

OEM Info

Specifications



OEM specifications

OEM Info

OEM Testing



OEM test procedures

OEM Info

Component Connector



Connector views and pin-outs

OEM Info

Component Location



Component location diagrams

OEM Info

Component Operation



Component operation and description

OEM Info

Wiring Diagrams



OEM and interactive wiring diagrams

Remove & Replace



OEM R&R procedures

60

After Repair Info



Post repair testing and validation

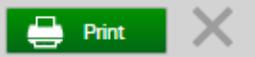
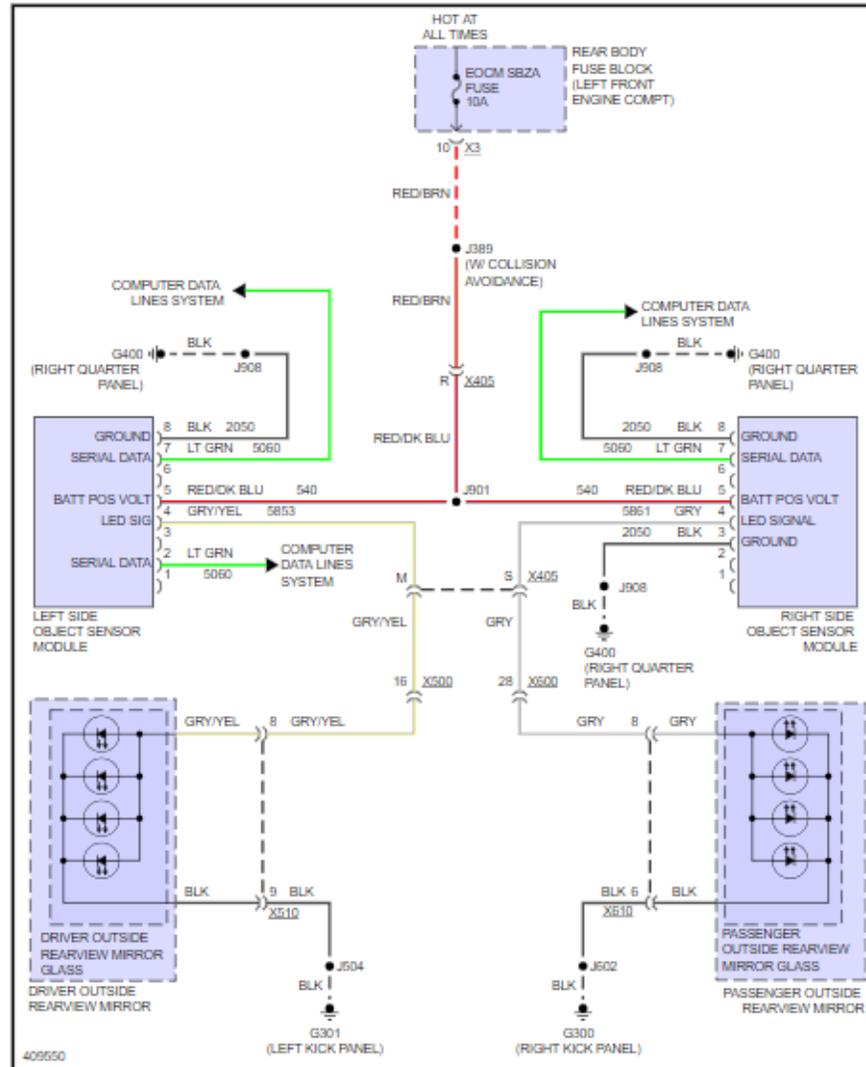


Fig 1: Blind Spot Monitoring Circuit



409550

Technical Bulletins



TSBs Recalls and Campaigns related to your search

OEM Info

Specifications



OEM specifications

OEM Info

OEM Testing



OEM test procedures

OEM Info

Component Connector



Connector views and pin-outs

OEM Info

Component Location



Component location diagrams

OEM Info

Component Operation



Component operation and description

OEM Info

Wiring Diagrams



OEM and interactive wiring diagrams

Remove & Replace



OEM R&R procedures

After Repair Info



Post repair testing and validation

← OEM Testing

Print



Outside View Camera 1 of 5



Front View Camera Module Scan Tool Information (With Active Safety System, UGN)



Front View Camera Module Scan Tool Data Parameters

Parameter	System State	Expected Value	Description
Operating Conditions: Ignition ON/Engine OFF/Lane Departure Warning ON			
System Power Mode	-	Run	The scan tool displays Off, Accessory, Run, Cranking or Undefined. This is the state of the ignition switch.
System Voltage	-	Varies	The scan tool displays the system voltage depending of the current battery voltage.
Frontview Camera Calibration Status	-	Learn Successful	The scan tool displays Not Learned, Learn in Progress, Learn Successful, or Error. This is the current state of the calibration.
Alignment Status	-	Yes	The scan tool displays Not Yes or No.
Invalid Signal Received	-	No	The scan tool displays Yes or No.
Frontview Camera Learn Mode Status	-	Yes	The scan tool displays Yes or No.
Frontview Camera System Status	-	On	The scan tool displays Off or On.
Frontview Camera Mode	-	Inactive	The scan tool displays Active or Inactive.

Front View Camera Module Scan Tool Information (Without Active Safety System, UGN)



Front View Camera Module Scan Tool Data Parameters

Technical Bulletins



TSBs Recalls and Campaigns related to your search

OEM Info

Specifications



OEM specifications

OEM Info

OEM Testing



OEM test procedures

OEM Info

Component Connector



Connector views and pin-outs

OEM Info

Component Location



Component location diagrams

OEM Info

Component Operation



Component operation and description

OEM Info

Wiring Diagrams



OEM and interactive wiring diagrams

Remove & Replace



OEM R&R procedures

After Repair Info



Post repair testing and validation

[Remove & Replace](#)

Print

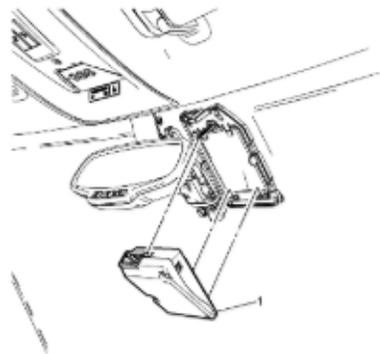


Outside View Camera 1 of 5

[Front View Camera Replacement \(With UFL\)](#)[Front View Camera Replacement \(With UGN\)](#)[Rearview Driver Information Camera Replacement](#)[Replace and Program Frontview Camera Module or Reprogram Frontview Camera Module \(with UGN\)](#)[Replace and Program Frontview Camera Module or Reprogram Frontview Camera Module \(without UGN\)](#)

Front View Camera Replacement (With UFL)

Fig 1: Front View Camera (With UFL)



Courtesy of GENERAL MOTORS COMPANY

[View Full-Screen](#)

Callout

Component Name



OEM Info



OEM Info



OEM Info

Component Location



Component location diagrams

OEM Info

Component Operation



Component operation and description

OEM Info

Wiring Diagrams



OEM and interactive wiring diagrams

OEM Info

Remove & Replace



OEM R&R procedures

OEM Info

After Repair Info



Post repair testing and validation

OEM Info

Parts & Labor



Replacement labor time and parts cost

OEM Info



[Return to 1Search™Plus](#)

[Estimate Guide Help](#)

[View Quote](#)

collision avoidance



Labor Parts Maintenance Fluids

Results for: *collision avoidance*

Restraints

Restraints Control Systems

Seat Belts

PRE-COLLISION CAMERA - Calibrate

APPLICATION	SKILL	LABOR	WARR	
All Applicable Models	B	0.4		+ Add

PRE-COLLISION CAMERA - Remove & Replace

APPLICATION	SKILL	LABOR	WARR	
All Applicable Models <i>Includes: Programming. Includes: Calibration.</i>	B	0.7		+ Add
Front,Module <i>Includes: Calibration.</i>	B	0.7		+ Add

PRE-COLLISION CANCEL SWITCH - Remove & Replace

PRE-COLLISION MODULE - Remove & Replace

PRE-COLLISION RADAR SENSOR - Calibrate

Labor: \$0.00

Parts: \$0.00

Subtotal: \$0.00

[View Quote](#)

Introducing ProDemand ADAS Quick Reference!

PRODEMAND CHANGE VEHICLE 2015 Cadillac SRX 3.6L Eng Premium RECALLS/CAMPAIGNS Contact Us Settings Logout

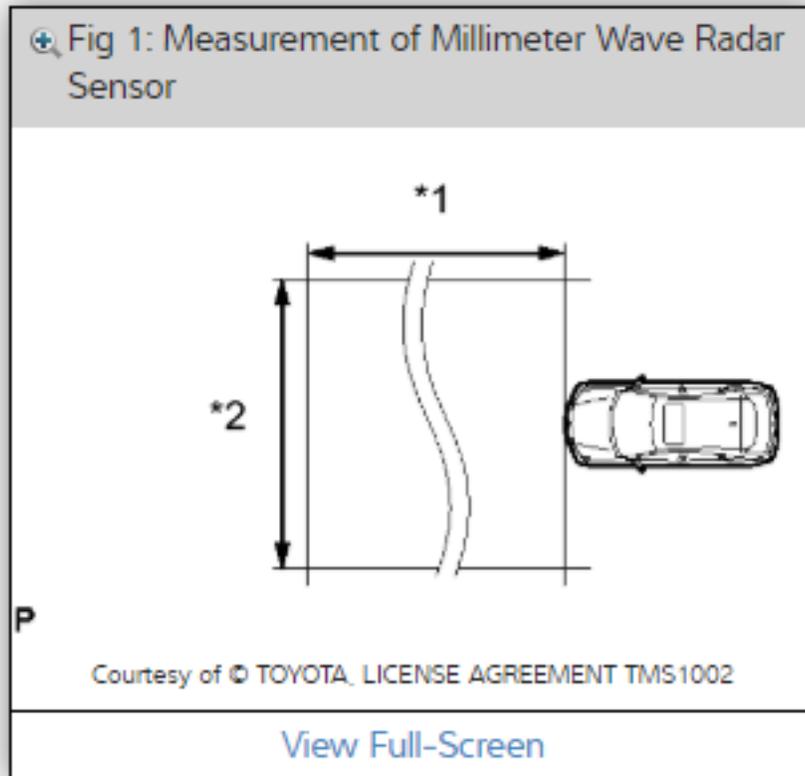
1SEARCH™ PLUS Search Enter Codes, Components or Symptoms Tuscany Demo 01

Technical Bulletins Common Specs Driver Assist ADAS Fluid Capacities TPMS Tire Fitment Reset Procedures DTC Index Wiring Diagrams Component Locations Component Tests Service Manual

Based on Analysis of 4,507 Repairs

Commonly Replaced COMPONENTS	Count	Common DTCs	Count	Common SYMPTOMS	Count	Top Search LOOKUPS
1. Battery	835	1. P0496: EVAP Flow Du...	44	1. Engine Does Not Start	139	1. Cabin Air Filter
2. Disc Brake Pad	765	2. P0014: B Camshaft Po...	8	2. Noise Heard From Bra...	51	2. P0496
3. Brake Rotor	571	3. P0442: EVAP System ...	7	3. Noise Heard When Dri...	39	3. Oil Life
4. Cabin Air Filter	406	4. P062f: Internal Control...	7	4. Air Conditioning Inope...	38	4. Common Specs & Pro...
5. Wheel Hub Assembly	353	5. P0174: System Too Le...	6	5. Noise Heard	35	5. Ecm
6. Tires	219	6. P0024: B Camshaft Po...	5	6. Noise Heard From Front	30	6. Hvac Control Module
7. Air Conditioning Refrig...	181	7. P0171: System Too Le...	5	7. Fluid Leaks From Vehi...	16	7. Side Object Sensor
8. Wheels	167	8. P0455: Evaporative E...	5	8. Noise Heard From Rear	16	8. Parking Sensor Syste...
9. Evap Purge Solenoid V...	143	9. C0045: Brake Pressur...	4	9. Brakes Vibrate When ...	15	9. Firing Order
10. Hvac Temperature Ble...	123	10. P0036: HO2S Heater ...	4	10. Engine Stalls	14	10. Engine Oil - Resetting

Challenge: Space Requirements



*1	Approx. 10 m (32.8 ft.)
*2	Approx. 14 m (45.9 ft.)

1500 sq ft needed in front of vehicle

To cover most makes/models:
80.6' Length
45.4' Width (3659 sq ft)

Challenge: Space Requirements

Working with Auto Care Association Emerging Technologies group to establish standardized, rational methods of calibration – will keep advised